JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

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EDITORIAL NOTES—GAS, &c.

The Inequalities of Competition— An Approaching Conference.

THE time has arrived when serious consideration ought to be given to the question of whether there cannot be some concerted action in an endeavour to remove the disparities that are found all along the line in the competition between municipal electricity and private enterprise in gas supply. Directly there is a hint of this kind, the trite and heretofore effective cry is raised by the electricians of an attempt to work an injustice to, and to hamper, a new industry. The electrical industry, however, cannot always remain new; and as a matter of fact it cannot be so characterized to-day. Looking down the list of municipal undertakings, we find some that have attained their majority, a very substantial proportion are in their teens, and very rarely in the list is a concern found that is not in its fourth or more advanced year of working. But the fact remains, though well out of its infantile and tender stages—as in the case of the pet of a family—a kind of maternal indulgence and licence are permitted by the powers that be to the electricity supply industry; and naturally the electricity industry wants to continue in this comfortable and favourable position as long as possible. We do not envy our competitors their position, but what is complained of is, that (having recourse again to the family simile) the pampering of one member of the family frequently inures to injustice to the others.

The gas industry stands somewhat in the relation of an elder brother to the electrical industry; and ever since the amending Electric Lighting Act of 1888, the gas industry has suffered from the excessive indulgence shown to municipalities in providing and supplying electricity. While gas supply has been hampered by penalty tests of various kinds, electricity supply has gone free; while protection has been given to the public by the authoritative testing and stamping of the meters that define the amount payable by the consumer to the gas supplier, no such corresponding protection has been given to the public patronizing electricity; while gas companies are compelled to suffer all the consequences of not keeping within their mains the gas they distribute, the electricity suppliers may come along and loosen the earth and carry on their operations about the mains to the injury of stability, may cause their deterioration and weakening by allowing escaping electricity —amounting to a large percentage of the output, three, four, or five times the percentage of escaping gas—to wander hither and thither at its own sweet will, may in fact do everything possible to aid and abet the escape of gas, providing too unventilated means for its lodgment, and then, after all this, any resulting damage falls upon the gas company; while a gas company have to suffer all the consequences of their own maladministration, the municipal electricity suppliers merely fall back upon the rates; while the gas company have to pay rates to the fullest possible extent, the competing municipal electricity supply undertaking does nothing of the kind; while the gas company may tender for a contract that is open for public lighting, the fact that their tender is the lowest, and the fact that the efficiency of their system is the highest, are not guarantees that the municipality with an electricity supply undertaking will, in the interests of the ratepayers, accept that which is most economical and most efficient; and while the gas company lose the business, they have with the other ratepayers to contribute to the additional expense and waste occasioned by this uncontrolled liberty of the administration of municipal electricity supply and of ordinary local affairs.

It is a really serious and baneful thing that there should be such great inequalities between the conditions of supply of the two commodities; and though isolated attempts have been made to partially alter the conditions, there has been no tangible effect. The gravity of the position, so far as it affects municipal competition and the acts of municipalities in connection with public lighting through the prejudice engendered by rival possession, was well accentuated by the remarks of Mr. Corbet Woodall at the last meeting of the Gaslight and Coke Company, and his protest was indeed well-timed. The inclemency of municipal competition—rate-aided and otherwise favoured—has had to be faced more by the Gaslight and Coke Company than by any other Company in the country. Without mentioning electricity supply companies, they must have approximately a dozen local authorities within the borders of their gas supply area all with their own electricity undertakings. And it is the possession of the electricity service by these Borough Councils that diverts competition from open fairness to an unfairness that, though it be unfair, is not unlawful because an indulgent Legislature has done nothing to prevent it. A case in point was mentioned by Mr. Woodall, where a Lighting Committee recommended acceptance of the tender of the Gaslight and Coke Company for the lighting of one of the most important and popular thoroughfares in London; but, at the behest of the partizans of electricity, the original decision of the Lighting Committee was reversed by a stratagem too clumsy to be concealed. The Gas Company's tender was recommended on the grounds of both economy and efficiency; but though the revised tender of the Electricity Committee was less than their first one, even now, neither on the score of economy or efficiency, can the scheme adopted compare with that of the Gas Company. It is manifest that the case in point has reference to the Marylebone Borough Council and Oxford Street. Thus it comes about that the Gas Company will have to bear a share of the extra cost for the doing of something that they could themselves perform with profit at a cheaper rate and with greater efficiency. This is one of the sins committed, in the name of municipal trading, against economical government, but which would not have been committed had the matter been left to the arbitrament of fair competition. That this is so, is attested in the prelude to the protest made by Mr. Woodall, wherein he says that, in the unbiassed field, the Gas Company have won some notable victories in the last two or three years—"in nearly a thousand cases in our "own district, gas lighting on modern lines has entirely "displaced electricity; in more than a thousand other cases, "electricity has been largely superseded by gas." For public purposes, whether the electricity supply be municipally or company managed, the merits of cheapness and efficiency ought alone to settle adoption and application. That they are not allowed to do so, incontestably avows the incompatibility of the administration of ordinary local affairs and municipal trading. Supposing the contract in question was one for electricity cables and not public lighting, if the Council did not accept the lowest tender—assuming quality and general merit to be equal—there would be an indignant outcry on the part of the "Progressive" section of the body concerned. But the same Progressives exhibit the inconsistent side of their administrative character when tenders for public lighting are sought.

When such things can be, it is high time for preventives. When such things are, it is time for action and remedy. It has been suggested that some concerted action should be taken to endeavour to bring to the common level of equality some of the inequalities that cluster about electricity and gas supply —to the injury of the latter. The idea is not our own. It springs from knowledge that there will shortly be a conference of the heads of the three Metropolitan Gas Companies, to see whether something cannot be done to secure for the Companies that equitable treatment in connection with public lighting contracts which is their right as owners of undertakings of statutory and established rank not less inferior to that of municipal electric lighting concerns, as public

servants equally with the municipal electricity departments, and as considerable ratepayers. It is prudent that a first step should be taken in this matter. The first step may—it is hoped will—lead to others that will have for their object the removal of more of the inequalities mentioned in an earlier part of this article. Of these, the relative inequitable rating of gas companies' works and municipal electricity undertakings is of importance. In 1905 the Gaslight and Coke Company had to pay in rates and taxes 3·38d. per 1000 feet of gas sold; the Commercial, 1·77d.; and the South Metropolitan Company, 1·59d.—an average of 2·64d. In the case of three municipal electricity undertakings, "rent, rates, and "taxes," only amounted to 0·08d. per unit; in the case of two others, 0·09d. per unit; in one, 0·1d.; in another, 0·11d.; in two, 0·12d.; in one, 0·13d.; in another, 0·17d.; and in a further one, 0·25d. Taking any of the greater number of these figures, and multiplying them individually by the number of units (say) at 3d. each that would equal in money value the price of gas, it is found that the majority of these municipal electricity undertakings are only paying, in comparison with the average payment of 2·64d. of the Gas Companies, from ¾d. to a little over 1d., which gives to the municipal undertakings an advantage of nearly 2d., and more than 2d. in the case of the Gaslight and Coke Company. That is an inequality the Legislature ought to insist on wiping away.

Municipal trading has often been put in the balance and found wanting; but municipal trading against which there is competition is conducted along lines, and propped up by practices, which cannot be described as fair or honest.

Gas from the United-Otto Coke-Oven Plant.

The financial trouble in which the Boston gas interests and the New England Gas and Coke Company were involved some four years or so ago, seems to have damped down all interest in this country in the United-Otto coke-oven system—at all events so far as the gas industry is concerned. In the absence of light on the subject from those most competent to furnish it, financial failure, in the case of the Everett undertaking, was taken as presumptive evidence of technical failure of the process; and the "Journal" took this, the common, view. Though often true, it does not always follow that financial failure of an industrial undertaking is the sign of the technical failure of a process. Were it so, the Welsbach Company and incandescent gas lighting would have long since been removed from existence, instead of flourishing to-day in our midst. With regard to the United-Otto system, and the criticism of some four years since, perhaps judgment was somewhat hastily drawn. But the facts were strong; and Dr. Schniewind permitted that judgment to stand, without submitting any evidence whatever that it was ill-founded. A beautifully-prepared volume now gives us the latest information about the "United-Otto "System of Bye-Product Coke-Ovens;" and a review of the volume elsewhere in this issue presents some interesting particulars about the system, from which we are able, from the point of view of the British gas practitioner, to draw certain conclusions. We are also indebted in this connection to Dr. Schniewind for the photographs and diagram that accompany the review.

The financial failure of the New England Gas and Coke Company did not result in the extinction of the Everett plant, for we are assured that it continues in "successful "operation." But no information is vouchsafed as to what constitutes "successful operation." As also attesting the merits of the system, particulars are privately given of some seven new installations—comprising altogether 739 ovens—that have been made since the financial disaster to the New England Company in 1902. In the case of three of these plants—at Sparrow's Point, Camden, and Duluth—the surplus gas is distributed for illuminating purposes, and over long distances at high pressures; while the surplus gas of the other installations is used entirely for fuel. If the 739 ovens are the aggregate of the past four years' installation work of the United Coke and Gas Company, it bears sorry comparison with the two years' installation business that preceded Dr. Schniewind's paper at the Glasgow Engineering Congress in 1901, in which the installations to that date are tabulated. But it certainly is an avowal of merit from practical experience to find that three of the seven new installations have been adopted to supplement former ones.

We have, however, to look at this matter only from the standpoint of the British gas industry. Dr. Schniewind advocated in his Glasgow paper and in one at the Ohio Association meeting the year following, that the United-Otto coke-oven system should be adopted as the primary plant of a gas-works, with a subservient water-gas plant. The suggestion is not, so far as this country is concerned, any nearer adoption than it was in 1901; and the figures in the volume reviewed in this issue will do nothing to animate interest in the manner hoped for by Dr. Schniewind five years since. At the best, as Mr. Charles Hunt said at the Glasgow Conference, the system could only be adopted as auxiliary to present gas-works plant in centres of industry where there is a good demand for metallurgical coke, and as a means of assisting in limiting the production of residuals, as metallurgical coke must be had, and residuals such as gas makers deal in must, as a natural result, follow from its production. But even that dream of a possible partial application has entirely faded in the light of subsequent experience. If the idea was thought in any way practicable in 1901, the happenings in Parliament, during the years since, in connection with the illuminating power of gas, have made it more certain than ever that the primary product of the whole of a gas-works plant must continue to be gas, and coke and the other residuals the secondary ones.

So far as can be seen in the volume before us, there has been no advance in the process either in the principles and methods of construction or in the results achieved during the interval between the Glasgow and Ohio papers and the present time sufficient to modify opinion. The Glasgow and the Ohio papers of 1901 and 1902 apparently portrayed a perfection beyond which it is impossible for those technically identified with the process to go. This is not said disparagingly, but purely from the aspect in which the gas maker in this country must perforce view the system. In the Glasgow paper, the total purified gas per net ton of coal had an illuminating value equal to 121,500 candle-feet—that is to say, 4000 feet of 18·5-candle gas, and of poor gas 5000 cubic feet of 9·5-candle power, or, averaging the illuminating power, we get only 9000 cubic feet of 13·5 candles. It is the difference between this 9000 cubic feet of 13·5-candle gas and the results of present gas-works practice that we have to make up from other directions in the United-Otto plant. However, figures very similar to those given above were quoted in the Ohio paper; and in the present volume we have mentioned 4300 cubic feet per ton (2000 lbs.) of 18-candle power gas, possessing a calorific value of 722 units. This is 46 per cent. of the total yield of the gas, and the percentage balance is "fuel" gas, having a calorific value of 560 units. No material improvement is shown here on the figures of five and six years since. The description of the plant in this the latest information to hand is of much interest, as a supplement to what has gone before; but all that the figures do in which the British gas industry is more especially concerned is to confirm the opinion formed some years since, that the system is altogether unsuitable for application in this part of the gas-making world, under the industrial conditions which prevail here, and especially under the modern and prospective conditions of gas supply. Others may use the system, and the nearest gas undertakings may see their way to relieve the users of the gas produced—but at a price.

Lax Discipline.

The explosion in the purifying-house at the old gas-works of the Coventry Corporation early in July, which unfortunately claimed the life of Edward Howarth, a foreman, is one of those sharp and melancholy reminders that appear to be necessary to keep some men fully alive to a sense of their responsibility, in whatever sphere they labour. It will not be a comfortable reflection for certain living men that, if there had not been negligence in replacing a purifier-cover, if there had been an inspection of the finished work instead of relying upon verbal testimony, and if, as was intended by the Engineer (Mr. Fletcher Stevenson), use had been made of electric lamps that had been purchased with the clear intention that disordered Armstrong lamps should be discarded, Edward Howarth would to-day have been working with his old comrades. It is necessary to gather together these and other facts before precipitately putting a too broad interpretation upon the admonishing appendix to the decision of the Coroner's jury. "We are unanimously of opinion," they said, "that there has been great laxity of discipline in the "management all round." This is a sweeping accusation; and an addendum differently worded, and more expressive

and caustic, might have been framed which would have had less comprehensiveness, and would have better fitted the occasion.

While admitting that there are, in the present connection, the all too plain evidences of laxness in duty, it cannot but be a matter of surprise to anyone acquainted with the old gas-works at Coventry that there has not previously been a disastrous accident during the several years that the works have been little better than a jumble of plant, with insufficient room for properly carrying on the operations. That there has not been, asserts a general care, which unfortunately was broken into throughout the incidents associated with this fatal event. The causes of the accident are summed up above; but the house in which it occurred is not altogether blameless. It is one of the old enclosed type, in which the means of ventilation hardly merit the name. This house is a relic of the past; and the views of Mr. Stevenson on this type of house is imposingly shown by his extensive system of open purifiers, with only covering roofs between the sections for the purifying material, at the new works at Foleshill. But in regard to the accident itself, from beginning to the end of the incidents, it forms a concatenation of misplaced confidence. It is impossible for a chief official to make personal inspection of the detail of all routine work; it is for that purpose that subordinate officials are appointed responsible to the chief. We need not elaborate this; but if the point is remembered in considering the jury's addendum to the verdict in this deplorable instance, its comprehensiveness will be properly curtailed. The main cause of the explosion was the negligence that permitted the escape of the gas; the effective cause was the introduction into the explosive atmosphere of the confined house of a lamp that the lesson of the Saltley explosion had caused Mr. Stevenson to supersede by electric lamps. Here was a perverse disregard by someone of the Engineer's expressed intentions. One could not, under the circumstances, except by distorting the facts evoked by the Coroner's inquiry, subscribe to the mitigating expression of view by the Town Clerk that the "accident was the result of a misapprehension, and a "very slight one, of the duties to be performed by the men." The practical lessons of this Coventry explosion, instead of being in any way mitigated, ought to be instilled, in their full significance, into the minds of all foremen and workers in confined places about a gas-works where there is any chance of leakage.

The Production of Tar from Coke-Ovens.

We have received a letter, but not for publication, which conveys the gratifying indication of an incipient interest on the part of producers of tar from coke-ovens in the current question of improving the value of the commodity by finding new outlets for it. Our correspondent's appreciation of the efforts that have been made to incite action in the endeavour to promote experiments in the application of tar to road surfacing is very encouraging. The writer is rather surprised there has not been more collaboration than present publicity suggests there has been between gas engineers and road surveyors in experimenting in this direction, as the interest of the former in improving their means of disposing of tar is as great as that of the latter in improving and making more tolerable the roadways under their charge. But there seems to be a little suspicion in the mind of our correspondent that, if the producers of tar from coke-ovens were to do a part in offering a quantity of tar at a reasonable rate with the view of popularizing its application for road-making purposes, this might be looked upon as an intrusion by the administrators of gas undertakings. There need be no fear of the kind. Coke-ovens there must be, production of tar by them is equally inevitable, and that tar goes to swell the supply. All contributors to the supply are in the same boat; and therefore anything that can be done, and from whatever quarter, will be taken as an earnest of a willingness to participate in active work to the common good of the producers. Our correspondent cordially endorses the view to which we have given expression, that the question is one "fraught with considerable interest, of a permanent and beneficial character, to the gas industry." Welcome will at all times be given to any information on this or other matters of common importance, that reach us from those interested in the bye-products of coke-oven working. [It is convenient to here direct attention to a letter which forms an excellent contribution to the general subject of the application of tar to road use, and which appears in our "Correspondence" columns over the name of Mr. Thomas Glover. We hope this will be followed by other contributions of personal experience and investigation. They will all be very helpful.]

Gas Companies and Electric Lighting Powers.

Though at one time it was considered by the Board of Trade that all electricity supply powers should have their origin in Whitehall, they have not been quite so particular of late; and last session saw various gas companies empowered directly by Parliament with authority to undertake the provision of electricity. These gas companies fully understand that their proceedings in this proposed new branch of business will be watched very narrowly by both gas and electricity suppliers; and the results of their enterprise may have a great impelling or deterring effect in the future. No one can yet say which. But the experience of one Gas Company in the North was not such that they declined an offer for the purchase of their electricity business. However, among the gas companies who have been clothed with electric lighting powers is the Ascot District. The shareholders have met for the last time under their old title; and they have now the distinction of being known as the Ascot District Gas and Electricity Company. By the statutory powers they have obtained, they have now the monopoly of the lighting in the district; but it is not altogether the simple thing that the Secretary (Mr. W. A. Schultz) imagines. He says: "It cannot matter to the Company whether they supply gas or electricity. Their duty is to supply artificial light; and it makes very little difference how they manufacture the light." Such an assertion is merely unsupported personal opinion. It does make a great deal of difference how the light is manufactured. When Mr. Schultz comes to consider the capital expenditure for electricity supply, the fact that in a residential district the capital spent is not continuously employed, that electricity is the only source of revenue in the business, and the price at which the electricity will have to be supplied per unit, he will find that, in regard to profitableness, there is a great deal of difference between the supply of light by gas and by electricity. But if there is a demand, we shall later on learn something more about this; and if there is any profit to be made from the supply of electricity in Ascot and the district, then the Ascot Gas and Electricity Company may as well have it as any one else. That we think is what Mr. Schultz really meant; but it is not what he said. However, this dual supply of gas and electricity by comparatively small companies in residential districts is an innovation which will be followed with keen interest. In the case of one portion of the Ascot Company's district—Sunningdale—there are already houses wired for the reception of electricity; so that it is possible the Directors of the Company may early find sufficient custom to warrant a start being made in the new branch of their business.

Removal of Tar from Water Gas.

In another part of the "JOURNAL" will be found a long paper on the above subject read by Mr. E. H. Earnshaw, of Cincinnati before the Western (U.S.A.) Gas Association, at their annual meeting in the spring. In it he describes an apparatus designed by him as the result of a number of experiments carefully carried out with the view of more effectually ridding water gas of its tar before reaching the purifiers. The superficial reader might be inclined to say that the well-known Pelouze and Audouin extractor is amply sufficient. Mr. Earnshaw found, however, that though the impingement method, as exemplified in that apparatus, seemed to be right in theory, and indeed was very efficacious in the case of coal gas, it was less so with water gas. He therefore designed an experimental extractor so that the number of impingement plates could be varied, as well as their distances apart and the diameter of the holes in the plates. It proved to be well adapted for its purpose. The perforations were so arranged that the gas passing through any plate impinged on the blank half of the plate next in series. Particulars of the experiments are given, as well as diagrams of the apparatus subsequently constructed for practical working. It bears a strong likeness to the Pelouze and Audouin extractor; but it is found at Cincinnati, where both machines are in use—one for coal gas and the other for water gas—that the character of the tar removed by each is very different. The coal-gas tar is heavier, and it

contains much more water and pitch, than the water-gas tar; and the quantity of tar oils obtained on distillation is very much less. The results of the experiments are summarized in an appendix; and in a second appendix, for which we have not space, the author gave details of certain of the experiments. In the course of the discussion on the paper, Mr. F. Egner said he thought that if Mr. Earnshaw had not had to keep his gas at a temperature of 110° Fahr. at the inlet of the purifiers he would not have had any trouble, as a little more cooling would have precipitated all the tar before the purifiers were reached. He fully appreciated the author's labours, and commended his paper earnestly to the attention of the younger members of the gas profession, as he considered it was worth studying and thoroughly digesting by them. Its value to the older engineers was, in his opinion, that it showed them a way to maintain their unpurified gas at the temperature named up to the inlet of the purifiers, and still to take out all the tar. The latter is certainly an object which all gas managers try to achieve; for tar in the purifiers is assuredly, in the words of a great statesman, "matter in the wrong place." We therefore join with Mr. Egner in his commendation of the paper, and leave it for the consideration of our readers.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 654.)

THE Stock Exchange has been affected by the fortnightly settlement and the state of the Money Market in connection with probable shipments of gold to New York during the month just commenced. Consols and other gilt-edged stocks are weaker on this account; but other departments have been influenced by the sharp fluctuations in American railway securities. In other departments, dealings have been on a very moderate scale; investment business, as usual at this time of the year, being very quiet. There has not been much movement in the Gas Market; but the tone has been good. Several stocks were quoted *ex div.* on the conclusion of the settlement of Thursday. Gaslight and Coke issues showed the most activity; the ordinary improving to 99-100 and the 4 per cent. preference to 108-111. Dealings were recorded in the ordinary stock at 98½ and 99¼ for cash; while for the next settlement up to 99¾ has been paid. Business has been recorded in the 4 per cent. preference up to 109½, in the 3 per cent. debentures at 87½, and in the 3½ per cent. maximum at 87¾ and 88¼. South Metropolitan has been quiet. Business was, however, recorded at 132½ and 133¼ in the ordinary, and the debentures changed hands at 87¾ and 86½. Commercial, which are now quoted *ex div.*, are steady, but inactive. In the Suburban and Provincial group also there was very little doing; most of the dealings being in South Suburban. Business was done in the ordinary at 123 and 124¼, and in the debentures at 129; but prices are quotably unaltered. West Ham ordinary changed hands at 105½; but there was not much doing in these stocks. Among the Provincial companies, Sheffield "B" and "C" rose 1. A similar rise was recorded in Newcastle debenture; while business was done on the local Exchange in the 4 per cent. preference at 101. In the Continental companies, Imperial were in request, and rose 2; business being recorded at 185¼ and up to 187, and in European at 24⅝. Among the undertakings of the remoter world, Buenos Ayres were dealt in at 12⅜ and 12½, Primitiva ordinary at 7 1/16, ditto 5 per cent. at 5¼ and 5 5/16, River Plate at 12⅞ and 12¾, Hong Kong at 20 5/16, and Cape Town ordinary met with some inquiry at 15½. On the whole, the Gas Market has been rather neglected; but a good tone prevailed.

The closing prices are shown in our Stock and Share List on page 654.

ELECTRIC LIGHTING MEMORANDA.

Some Features of Municipal Electricity Accounts—Mournful Progress, Deficits, and Reductions of Net Profit—Improved Recognition of Depreciation—Motor Power Business—Hiring and Wiring.

IN making a review of the municipal electricity accounts for the past financial year, from the standpoint of results rather than the internal workings that contributed to the production of the results, it is impossible for it to be of anything but of the most superficial character—extracting a point here and a point there, and giving illustrations, without attempting completeness. If the few municipal undertakings that have extraordinarily fine districts are excepted, and the great remainder are taken, the electrician must be of volatile temperament who can survey their results with any degree of real satisfaction. It is the pride of the electrical engineer to reduce his works costs; and almost imperceptible fractions of reductions per unit are laid hold of and set up as something worthy of the admiration and the worship of the whole electrical world. But works' costs are not the beginning and the end of the making or undoing of an electricity department's accounts. Too great a devotion to them, important as they are, may be very detrimental to the final success of a department. In the quest for fractional savings, some very considerable whole numbers may go to capital, which demand their proportion of sinking fund and interest; and there may be neglect in the commercial and other departments. There are, therefore, in these municipal accounts many items other than works' costs that have to come into the calculation; and in some of them there is a constant increase. Capital charges, repairs and maintenance, and expenses generally are seen to have an upward tendency, and, in several cases, out of all relation to the additional business. The new business does not come in at a rate to make "net profits" visibly swell; and into such amounts as are described as "net profits," it is an act of mercy not to inquire too narrowly. One very striking feature in the accounts examined is the number of electricity departments that made during the last financial year reductions in the price of electricity—not that in all cases their accounts justified the step, but the want of mobility in their businesses, through the strong defences of gas and its telling offensive tactics, made reduction in price an absolute necessity for preservative and persuasive ends. In many cases, those reductions have not given the measure of impulse to the business that was expected; and meantime capital and other charges are increasing.

There have been references above to net profits, in which, in connection with municipal trading concerns, we do not believe, after proper provision has been made for reserve and depreciation and for repayment of subsidies from the rates, with some relief of the abominable expense of public electric lighting. No public service ought to be run with the view of making a profit to succour the rates. The service being a public one ought to be rendered at the lowest possible cost; and there should be no making of money out of one section of the community for the benefit of another section who have personally contributed nothing towards its making—not even capital. According to the Socialistic dogma, there is an unrighteousness about the so-called "unearned increment" that the capitalist obtains for the use and risk of his money in industry and commerce; but Socialism and Collectivism will not—so easy is it for some people to make opinions suit circumstances—defer to the view that there is a greater unrighteousness in the "unearned increment" of ratepayers who contribute neither work, custom, nor capital towards the making of the money. Holding these views, it follows that ratepayers ought not to be called upon to subscribe to deficiencies which they have not helped to create, and that municipal undertakings should be entirely self-supporting. Unfortunately, in all but a few cases, the one motive for municipal trading in electricity has been, colloquially put, "profits in aid of the rates," which certainly in some cases can do with aid through lavish spending. If consumers took energetic measures against being made the providers for non-consuming neighbours of relief from the responsibility of bearing their proportion of the financial burdens of modern municipal administration, which surceases equity as between ratepayer and ratepayer, or if municipalities were deprived of the power of making profits over and above the bounds described above, municipal trading would lose its savour. The lesson has been learnt, and learnt with much grief, that electricity supply is not such a generous profit producer as it was expected in the early days it would be. Where there is any increase in net profits, it comes at a mournful and depressing pace; in other cases there is an actual shrinkage of profits; and in other cases again deficits have to be recorded.

This is not an exhilarating condition of affairs. Without any attempt at picking and choosing, we have, as the last-issued accounts have been published, made notes here and there from them, and give a few examples, fairly sprinkled through the country, to show that the assertions as to the absence of any general striking prosperity are well founded. Take a few of the concerns placed in the first category, to indicate the slow progress—remembering that the profession of the figures being really net profit, or net profit obtained after adequate charges, has to be accepted with an amount of dubiety. Barnstaple has earned a net profit of £269; Birkenhead, £2210 (against £2109); Birmingham, £4909; East Ham, £960; Eastbourne, £1301; Gloucester, £1402; Hereford, £8 4s. 2d. (against £2 6s. 4d.); Kingston-on-Thames, £500; Leeds, £3245; Leicester, £6883 (against £6521); Leyton, £1104; Norwich, £5603 (increase only £170); Stafford, £446; Taunton, £423; Wakefield, £1060; West Bromwich, £1931; Wimbledon, £338; and West Hartlepool, £500. Are these considered by municipalities adequate net profits, after paying only working expenses and charges on the heavy borrowed capitals? We think not. However, there are a few remarks to be made about some of the figures. Certain of the undertakings have been compelled to reduce their charges—Gloucester among the number. In the Electrical Engineer's report on the subject, he says the Council did the right thing in reducing prices, seeing that at the old rates a temporary check was met with, owing to the reduced charges for gas lighting, and the improving and cheapening of the incandescent gas mantle. But with the reduced rates, the amount of net profit does not suggest that the "temporary check" has come to an end. The electrical engineer who will fairly and squarely look his competitor in the face and admit that he finds strength there, is a man we can admire. The magnificent increase of profit to £8 4s. 2d. at Hereford is noteworthy; as is also the fact that the Council are proposing the expenditure of

£6250 on new plant. With the additional expenditure, and the present rate of increasing profits, there will, we fancy, soon be a deficit at Hereford. The Leicester profits are good, and indicate that the dual management of gas and electricity works can be conducted without detriment to the latter. Regarding Stafford (where there is also dual management), the surplus is £446; but as £1400 has been charged for depreciation, there is a deficiency of £954. But Stafford is not Leicester.

Next to those municipal departments that have honestly or by occult devices in accountancy made "net profit," are those that, by reason of increasing capital and maintenance charges and reduction in prices, exhibit declines in their earnings. Here are examples. The surplus of Bradford has decreased from £8709 to £3568; Colchester, from £2433 to £1758; Glasgow, from £111,775 to £104,425; Hanley, from £1808 to £1449; St. Pancras, from £13,098 to £9441; and South Shields, from £1988 to £1038. The position at Bradford looks very ugly. Not only has there been the large reduction of net profit by over £5000, but, in addition, the renewals fund has been depleted to the extent of £17,244, making the figure at which it now stands £10,545. Out of this there is to be taken £4000 to meet next year's expenditure on repairs. What have those to say to this who denounce provision for depreciation as a wicked device of the enemy of municipal trading? With reference to Glasgow, the undertaking is in an exceptional position. With the Corporation, the financial integrity of their electricity undertaking has always had first consideration; and they are reaping the reward to-day. It is interesting to observe that, though net profits diminished as indicated, revenue increased by £9470, of which £7121 was represented by power, and only £2349 by lighting. There is a significance about these figures which cannot pass unobserved. Though it does not come into this class of undertakings, the Manchester Corporation Electricity Committee are showing a strong desire to husband their financial balances; and in this regard they are allowed to do what Alderman Gibson and his colleagues of the Gas Committee are denied. The Gas Department are compelled to contribute heavily to the rates year by year. In the Electricity Department, the gross profit last year was £188,082; and after paying interest and sinking fund, the balance is allocated as follows: Renewals account, £40,000; reserve account, £16,206. This is sound finance; but why one policy for the Gas Department and another for the Electricity Department?

Following on, there are those undertakings that are still producing deficits, because the municipalities directing them will not apply the elementary business principle to their operations, of selling at a price that will pay expenses. Where would a company or individual soon be who made deficits year after year after the manner of these electricity concerns? Instances of this unprofitable class of undertakings are furnished by Barking with a deficit of £557; Bath, £338; Brighton, £976; Gillingham, £521; Kendal, £692; Oldham, £451; Southend, £1003; Surbiton, £741; Tonbridge, £588; Shoreditch, £922; while Whitby only contrived to make £552 towards their capital charges. With regard to Brighton, the gross receipts only increased by £1627; but capital charges on account of the new works demand £7224 more than last year. The Bath City Council must long since have secretly and deeply repented of their folly in purchasing the electricity undertaking. By no way can they appear to escape deficits. In the last report it is said that the output has increased by some 60,000 units per annum; but of this amount more than half, or 32,559 units, are due to public lighting!

It is obvious from an inspection of the accounts before us that there is an advancing appreciation of the fact among electricity committees, who have been, as many still are, hard to convince, that all forecasts of the future must take into greater consideration the augmenting necessities of maintenance and depreciation. These things in electricity undertakings do not lessen—they grow, though there has been a feeling among local authorities that electricity plant is practically exempt from destruction. And as the Chairman of the Norwich Corporation Electricity Committee asserts, there is no industry so liable to sudden changes as the production of electrical machinery. Electrical engineers are only too well aware of this; and many of them execrate the fate that has placed them in charge of undertakings that were built and equipped some years ago, when municipal authorities were rushing madly after installations, the plant of which, on account of its inefficiency compared with modern types, ought to be, if funds would permit, immediately scrapped. However, on all grounds, it is a satisfaction to find more municipalities taking thought for the morrow; but it is the lesson of yesterday that has produced the change.

There are varied experiences in connection with the motor power business. In Glasgow, motors take one-third of the units of electricity sold, and provide one-sixth of the revenue. From Manchester it is reported that a gratifying feature of the year is the increased power demands of several prominent firms, "estimated" at 7 to 8 million units per annum. At West Bromwich, the motor requirements are nearly equal to the private lighting business; the units sold being 210,810 for motive power, as compared with 234,384 for lighting. But then what do the lighting consumers say to paying £2823 for about the number of units of electricity that the motor power users obtain for £884? The difference is too great, and requires justifying. At Leeds, there are 1040 motors in use aggregating 5471-horse power! There must be some rather small motors among them. However, it is obvious that by fair charges or otherwise—more otherwise than fair—the motive power business is pushed by electricity departments.

In the accounts we do not find much about the free or assisted wiring and fitting business. But the West Bromwich Electricity Committee set out their accounts in a manner which shows what a phantasm this part of their trading has proved to be. In their case the net loss in the present accounts is declared at £330! Therefore this is not a business the Committee are likely to actively push. We wonder, too, what would be presented to view in the way of loss if a separate balance-sheet was made up for their power business. Looked at all round, the municipal electricity industry has not much over which to vaunt as a result of the operations of the last financial year.

PREPARING FOR THE ENGINEERING AND MACHINERY EXHIBITION.

PRELIMINARY notice has already been made in the "JOURNAL" of the Engineering and Machinery Exhibition that will be opened at Olympia next Saturday week. The question has been asked far and wide in the engineering profession, Is the exhibition going to be a success? Very grave doubts have existed. Engineering has become so specialized and sectionized that it is a gigantic task for anyone to undertake to get together a really representative display. Each branch of engineering can easily support an exhibition of its own, and fill any large available building without exhausting its resources; and this being the case, there is a disposition, when it is thought advisable to hold an exhibition, to confine it to a special section of industry, and to the exemplification of the utilitarian side of its productions, rather than take part in an exhibition of a general character. And for our own part, the opinion is that this view is the right one, and that from the specialized exhibition the greatest good accrues. The gas industry some eighteen months or so ago held its great exhibition at Earl's Court, the electrical industry followed suit about a year later, the motor car and cycle industries have their annual shows, the laundry, printing, brewing, and other industries in which mechanical engineering comes largely into play also have their periodical displays. From not one of these directions does it appear likely that there will come anything that can be called really representative; and yet the Organizing Managers (Messrs. Smith and Bridges) are able to announce that the number of exhibitors will be about 200, and that practically the whole of the space available at Olympia has been taken. Looking down the list of exhibitors so far registered, the surmise is confirmed that those exhibiting firms with which the gas industry have the nearest intimacy are not entirely, but only through specialities, associated with the industry—some, of course, to a much larger extent than others, such as Messrs. Crossley Brothers, James Keith and Blackman Company, Limited, and Messrs. Tilley Bros. The firms referred to are:

Bailey, W. H., and Co., Ltd.
Barker, John, and Co., Ltd.
Bateman's Machine Tool Co.
Beldam Packing and Rubber Co.
Boardman Bros.
Cambridge Scientific Instrument Company
Carborundum Company
Cochran and Co., Annan, Ltd.
Combination Metallic Packing Co.
Consolidated Pneumatic Tool Co.
Crossley Bros., Ltd.
De Laitte Gas Machine Syndicate.
Dexine Patent Packing and Rubber Company, Ltd.
Keith and Blackman Company.
Kynoch, Ltd.
Mica Boiler Covering Company.
Sanders, Rehders, and Co.
Stirling Boiler Company, Ltd.
Sturtevant Engineering Company.
Temperley Transporter Company
Tilley Bros.
United Kingdom Lighting Trust.

Even from the complete list, it is totally impossible to say whether the exhibitors will rise to the height of making the display at Olympia truly illustrative of the branches of mechanical engineering which they represent; but a fortnight hence there will be some opportunity of judging. Whatever the final result, the exhibition cannot be devoid of interest for anyone concerned in mechanical progress; and all gas engineers are so concerned. It is twenty-one years since there was a general engineering and machinery exhibition; and during that period, the scientist and the mechanician have worked with marvellous rapidity and result. It is our nature to accept each new step in progress somewhat frigidly and almost as a matter of course; and it is only by making periodical reviews, and comparing the present with a fairly distant previous date, that there can be a full conception of progress. Such comparison the exhibition will enable engineers to make; and it will then be seen that the march of scientific engineering and improvement in mechanical appliances has during the past score years or so been indeed a most victorious one.

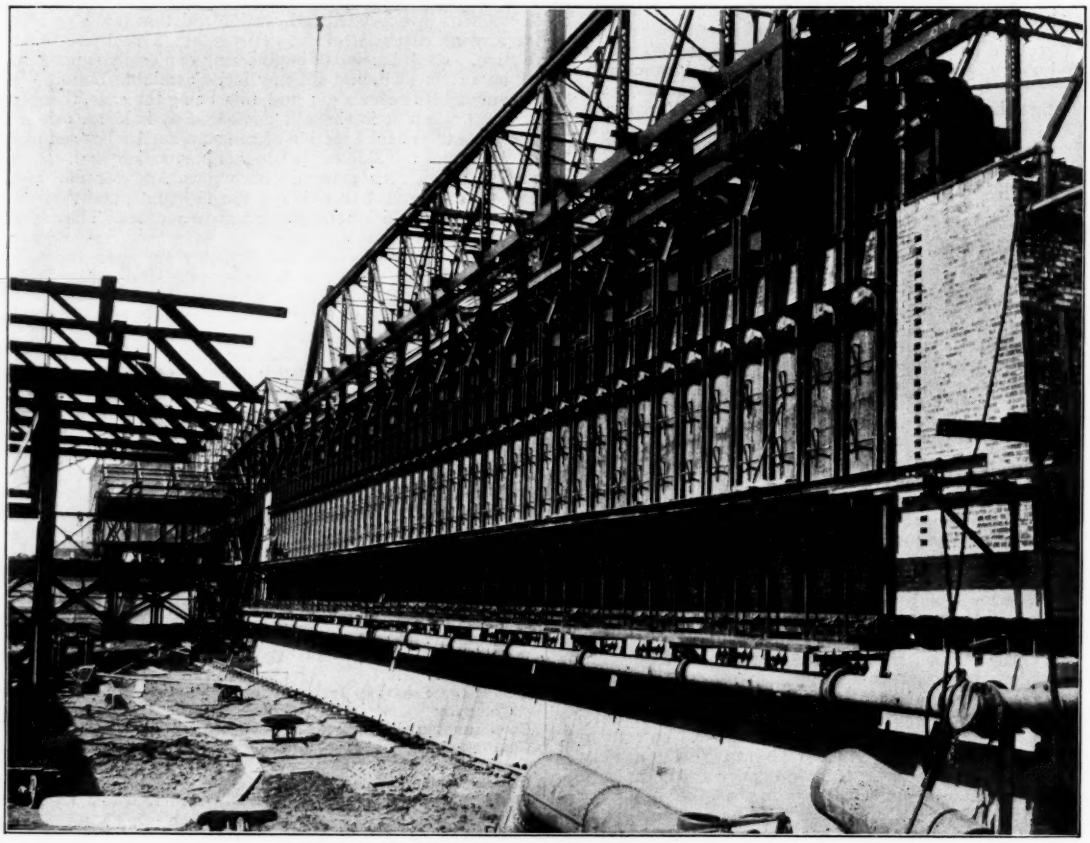
There will be among the many features of the exhibition one which, there is no doubt, will prove a great attraction. It is a huge electric fountain and air circulator, which will occupy a central position in the building. This is the work of the James Keith and Blackman Company, Limited. The exhibits will not monopolize interest. It is expected that a series of lectures will be arranged; and there will be music by military bands and other recreative attractions.

RECOVERY COKE-OVENS.

Considered solely in its relation to the gas-supply of the United Kingdom, this subject is almost in the nature of a hardy annual. It crops up periodically—affording opportunity for the expression of pious opinions as to its merits—but advances no further. Yet in America it is very much alive; for not only is the recovery coke-oven coming, as in this country, into extended use for the production of metallurgical coke, but also for the production, as a bye-product, of illuminating gas, large quantities of which are now distributed from coke-oven works through various populous centres. It is not, however, to be supposed that these ventures have been uniformly crowned with success, or that the coke-oven system can, under all conditions, successfully compete with the reducing retort system. On the contrary, the former have not been unattended by financial disaster, though from what cause it is impossible to say; while all experience in this country goes to prove that the retort system is likely to hold its own, except perhaps where the conditions are eminently favourable for the production of gas as a bye-product. This should be the case when a large demand exists for metallurgical coke at a considerable distance from a coal field.

We have before us evidence of the space which this industry occupies in America in the shape of a handsome volume published by the United Coke and Gas Company of New York, of which Dr. F. Schniewind—who contributed a paper on the subject to the International Engineering Congress at Glasgow in 1901—is Vice-President. It is entitled "A Short Treatise on the Destructive Distillation of Bituminous Coal, with Special Reference to the United-Otto System of Bye-Product Coke-Ovens." Although, as this title indicates, the main object of the publication is to set forth the merits of a particular type of recovery coke-ovens, much information may be gathered from it concerning the subject generally, and the place it holds in the industries of the United States. Commencement is made with a comparison between the three types of apparatus used in the destructive distillation of coal—viz., the beehive oven, the ordinary gas-retort, and the bye-product coke-oven—much to the advantage of the latter, which, according to the illustration, is the only smokeless system.

Excellent illustrations, by the way, are a special feature of this well got up volume, three of which are reproduced. They are employed to show the difference between the carbonizing capacity of a beehive oven coking 5 tons of coal in forty-eight hours (the product of which per twenty-four hours is 1·6 tons of coke) and that of a United-Otto oven, coking 10·5 tons of coal per twenty-four hours, the product of which per twenty-four hours

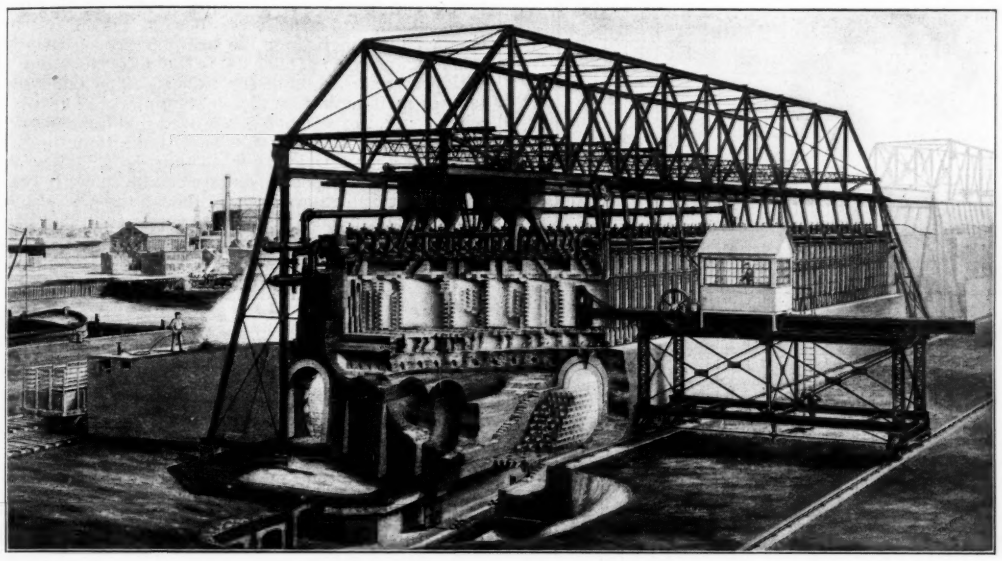


A Range of Bye-Products Coke-Ovens nearing Completion.

is 7·9 tons of coke, besides tar, sulphate of ammonia, and illuminating gas. In another illustration a bed of ordinary retorts and a battery of bye-product ovens are seen side by side. It is not necessary to follow the author in his description of the various stages in the development of the present-day bye-product oven, as illustrated, the dimensions of the coking chamber of which are 33 feet long, 6 ft. 6 in. high, and from 17 to 22 inches in average width—containing 6 to 7 tons of coal per charge. From thirty to fifty of such retorts or ovens are placed side by side to form a battery. The oven is sometimes built with a taper, so as to be wider at the discharge side than at the pusher side; the object being to facilitate the discharge of the coke—the taper varying from 4 inches to 1 inch, according to the nature of the coal to be dealt with. The iron doors by which the ends of the ovens are closed, are raised and lowered by a winch actuated by electricity. The coal is charged into the ovens from an electrically-operated lorry having spouts which deliver the coal through corresponding charging holes in the oven top. This lorry is sometimes carried on an overhead steel trusswork, so as to relieve the oven walls of its weight.

This oven—the Otto-Hoffmann—is heated regeneratively, with a reversing arrangement; the air being heated up to 1800° Fahr. The amount of chequer-work in the regenerators is so regulated that the waste gases escape to the stack with only sufficient temperature to secure ample draught—namely, about 550° Fahr. The period of reversal is usually some 30 minutes. Other forms of oven are described, and advantages are claimed for the United-Otto oven in the absolute prevention of any damage to the coking chamber from contraction and expansion, perfect accessibility of the foundations, regenerators, heating system, and reversing apparatus; increase of oven dimensions; and the use of automatic machinery wherever practicable. It is also claimed that this oven, with its accessories, is adapted to the production of high candle power gas and a maximum yield of bye-products, without affecting the quality of the coke produced. In the construction of this oven, a novelty has been introduced in the use of grinding wheels, by which the bricks are all brought to a uniform size and thickness without recourse to chipping. It is claimed that this is economical, besides resulting in a very high quality of workmanship and a practically gas-tight wall of great strength, the resistance of which is enhanced by the vertical flue system; the heating flues running perpendicularly along all the portion of the oven wall against which the coal can exert any pressure. The air for combustion is supplied to the regenerator by a fan, which equalizes the distribution to each oven and reduces the amount of chimney draught necessary.

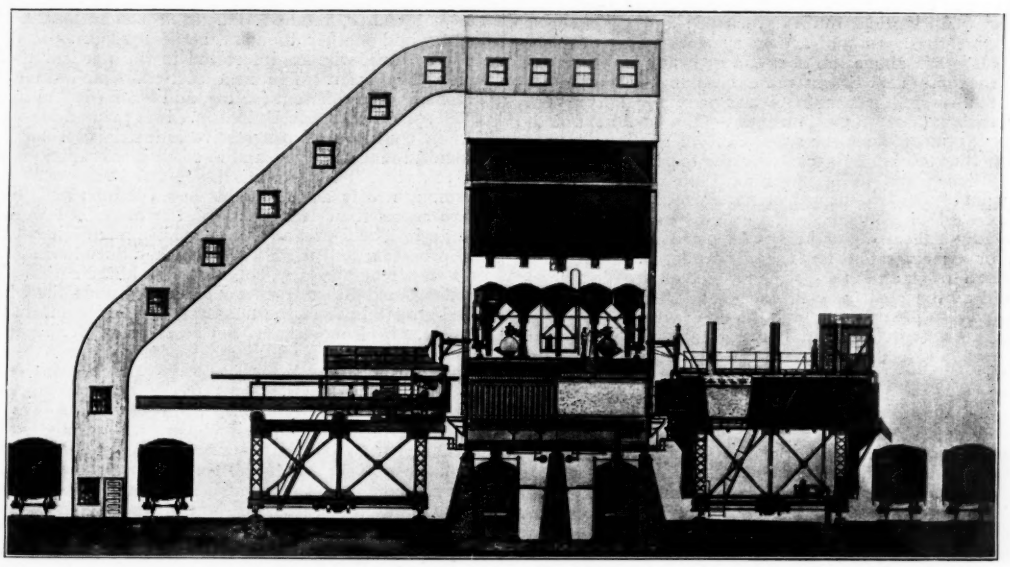
It is claimed that, by the system of heating employed, ovens up to 43 feet in length can be properly heated. From the time that the coal is discharged from the waggon until it is in the oven, it is handled entirely by machinery; a conveyor with automatic feeder delivering it to the crusher, or straight to an elevator as the case may be. This elevator delivers the coal into an overhead bin, regular distribution in which is ensured from an automatic device. From thence it is fed by gravity to the coal-lorry below through a number of shoots controlled by a single lever; the amount of coal drawn being checked by weighing if desired. After the oven has received its charge of coal, this is levelled by a mechanical leveller; the levelling bar being carried on the pusher and operated through an opening in the oven door. There are various devices for quenching the coke, but perhaps the most interesting is that known as the Moore coke-quencher, consisting of a rectangular receiver, of the approximate shape of an



Sectional View of Otto-Hoffmann Bye-Products Ovens.

oven, and large enough to contain the whole of one charge. The sides are of cast-iron and of cellular construction.

The top and bottom are lightly covered in with cast-iron plates, and the ends are provided with closely fitting doors. A cast-iron link conveyor, driven by a motor, runs in the bottom. The whole machine moves on rails parallel to the face of the oven battery, and is operated by electric motors. When it is desired to push an oven of coke, the quencher is placed exactly in front of it, and connection is made by means of swinging doors and a drop bottom, so as to guide the coke from the oven directly into the receptacle. The movement of the coke is assisted by the motion of the conveyor in the bottom of the quencher chamber. When the charge has been pushed from the oven into the quencher, the doors are closed and the quenching water is admitted. The violent generation of steam is taken care of by vertical stacks in the roof of the quencher. The quenching chamber is completely



The United-Otto Bye-Products Oven.

filled with steam, and remains so until the charge is quenched, practically excluding the air, so that the silvery-grey colour of the coke is preserved as in the beehive product. When the quenching is complete, the door furthest from the ovens is opened, and the coke is discharged into the railroad car below by operating the conveyor.

By means of a table or schedule, the mechanical handling of coal and coke is traced to the separation of the gas and various bye-products, and the production of coke sized to suit all requirements. Another diagram shows the candle power, calorific value, and volume of coke-oven gas given off during each hour of the coking process [see next page]. This is divided into "surplus" gas, averaging 18 candles illuminating power, and 722 B.Th.U. calorific value, and "fuel" gas, having a calorific value of 560 B.Th.U. Of the former, it is stated there is a yield of 4300 cubic feet per ton of 2000 lbs., or 46 per cent. of the entire yield of gas, containing, calorifically considered, 52 per cent. of the total heat value of the gas. With a coal of somewhat higher volatile matter, yielding an excellent quality of foundry coke, a surplus of 4800 cubic feet corrected volume of gas per net ton of coal is said to have been delivered for distribution for months in succession; the illuminating value in this instance being maintained at 18 to 20 candle power by the transfer of the benzol from the fuel to the rich-gas portion. For what reason it was thought desirable to

maintain this high illuminating power is not stated; nor why it should be necessary to preserve the distinction indicated in the diagram between "surplus" and "fuel" gas. To our minds, all distributed gas must be regarded as fuel gas, since by far the largest portion is used for purposes for which calorific value alone is of importance.

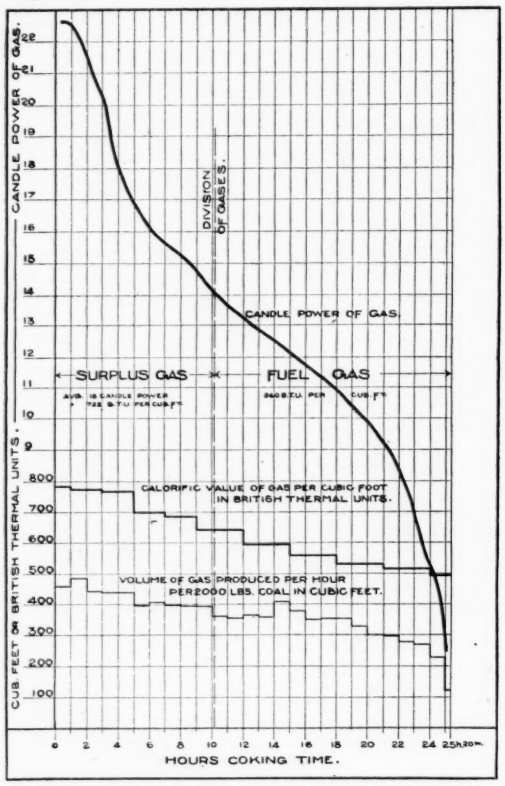

CANDLE POWER OF GAS.
CUB. FEET OR BRITISH THERMAL UNITS.
DIVISION OF GASES.
CANDLE POWER OF GAS.
SURPLUS GAS
FUEL GAS
CALORIFIC VALUE OF GAS PER CUBIC FOOT IN BRITISH THERMAL UNITS.
VOLUME OF GAS PRODUCED PER HOUR PER 2000 LBS. COAL IN CUBIC FEET.
HOURS COKING TIME.

Diagram showing the Candle Power, Calorific Value, and Volume of Coke-Oven Gas.

The operation of coking is explained with the aid of a diagram showing a core in the centre of the charge similar to that which is noticeable when vertical retorts are used; and it is observed that, comparing the heating of a coke-oven with that of a gas-retort, the gas space above the coal charge is less highly heated in the coke-oven. This causes more cracking of the hydro-carbons in the gas from gas-retorts, resulting in a higher percentage of free carbon (soot) in gas-house tar. The treatment of the gas and bye-products forms the subject of yet another diagram, which shows that the "rich" gas is delivered to purifying, storage, and distribution plant, to be used for illumination purposes, while the "poor" gas is deprived of its benzol by washing with crude oil, and is then returned to the coke-ovens for heating the same; the ammoniacal liquor being converted into sulphate of ammonia, or concentrated for use as crude ammonia. The method which originated in Germany of compressing finely crushed and wetted coal to such consistency that it will stand being charged into the oven through the door without support, is referred to as being capable of but limited application with advantage; it being inadvisable to use it with coal which expands much during coking, although with certain coals such treatment tends to improve the physical structure of the coke. Much is said as to the quality of recovery oven coke, and the prejudice which formerly existed as to its use in the blast-furnaces, in which connection it is stated that "the use of properly crushed and sized coke, as a substitute for bituminous coal, is coming to be recognized as the only real and permanent solution of the smoke question." Accordingly, crushing and sizing of the coke are systematically resorted to, and "of the large output of the New England Gas and Coke Company, at Everett, Mass., some 200,000 gross tons a year are disposed of for domestic and industrial service; a similar amount being used for firing locomotives, particularly in suburban service, because of its smokeless nature."

When the gas from these ovens is used for power purposes, it has not been found necessary to purify it from sulphur; the action of the latter in the engine-valves and cylinder not being sufficient to warrant the cost of its removal. The most advantageous field for the disposal of surplus gas is, however, stated to be in ordinary city distribution for illuminating, fuel, and power purposes; and this renders purification necessary. Such gas, produced by the principle of separation indicated by the diagram, as capable of being pumped under pressure for long distances, and in such service suffers, it is said, a minimum loss of candle power by condensation of illuminants. "The results of the Everett plant, which delivers daily between 6,000,000 and 7,000,000 cubic feet of illuminating gas, may be cited. In the case of the plant at Sparrow's Point, the gas is pumped eleven miles under pressure to Baltimore, and at Camden it is pumped thirty-eight miles to Trenton, N.J."

This rich coke-oven gas is showed by analysis to be superior in heating value to either retort coal gas or carburetted water gas of much higher illuminating power; but in closing our review of this highly interesting and profusely illustrated volume, we are impelled to remark that there is not in it any encouragement to the view that this system is one which can lend itself to the distribution of low-grade gas. On the contrary—whether by mere force of circumstances, or deliberate design, it is difficult to say—it is employed in America for the maintenance of a standard of illuminating power as high as to be altogether out of harmony with progressive ideas on the subject. The mind revolts at the idea of maintaining an illuminating power of 18 or 19 candles, when general experience has proved that a much lower standard is sufficient for all requirements. At the same time, it has to be admitted that this is, after all, largely a matter of cost; and possibly in this respect advantage can be shown to result from the supply of this high-grade gas, although the prices charged for gas in America can hardly be said to support the suggestion.

FOREIGN LABOUR STATISTICS.

THERE is a great deal of information appertaining to the labour question to be derived from astudy of the third annual volume of Abstracts of Foreign Labour Statistics, which has just been issued by the Labour Department of the Board of Trade. The report is a bulky one, consisting, of course, mainly of figures; and it is prefaced by an explanation by Mr. A. Wilson Fox. The subjects dealt with are wages and hours of labour, Trade Unions, trade disputes, conciliation and arbitration, workmen's insurance, and co-operation. France and Germany are represented in every one of these sections; Denmark, Holland, Belgium, Austria-Hungary, Italy, and the United States, in five out of the six sections; and Japan and Spain, in one section each. Other countries dealt with in some of the sections are Russia, Norway, Sweden, and Switzerland—the total number referred to in the statistics being fourteen. Attention is drawn to the fact that the methods of collecting information, and of computing and presenting results, adopted by the various authorities compiling the original statistics, differ widely; and therefore great caution is necessary in making comparisons between the figures for one country and those for another.

The first section—wages and hours of labour—is greatly influenced by differences in the nature and arrangement of the statistics, and by the fact that the classes of workpeople included under a given heading are not identical in different countries. This, of course, renders difficult a comparison between one country and another, though each set of figures is deserving of study by those who are interested in the particular countries to which they refer. The next section, which refers to Trade Unions, is on a different footing, and it affords a clear indication of the spread of Trade Unionism. It is pointed out in the report that in countries of progressive industrial development Trade Unionism makes steady, and in some cases rapid, growth. During the years 1899 to 1904, the Social Democratic Societies of Germany nearly doubled their membership; and they now embrace more than two-thirds of the organized workers of the country. The Christian Societies have made almost equal relative progress; and the Hirsch-Duncker Societies, though of less importance numerically, continue to hold their own. Turning to France, much the same state of affairs is found; there having been rapid growth both in the number of societies and in their membership. In Denmark, on the other hand, for some reason or another, there has been a falling off in both respects since 1900. The figures show that in 1904 only the United States were ahead of the United Kingdom in respect to the number of Trade Unionists. In that year, there were in the United Kingdom 1,866,755 Trade Unionists (including female members and members abroad); in Germany, 1,466,625; in France, 715,576; in Austria, 189,121; in Denmark, 90,111; and in the United States, 2,067,081. The tendency to combine is, of course, strongest in the case of skilled labour; and in Germany the largest trade societies are those in the building industry, which, it is stated, number a quarter of all the members of the Social Democratic group of Unions. It is in this industry that the men have in recent years succeeded most in concluding Collective Wages Agreements. The metal trades come next with almost as large a membership. We learn that in France by far the largest Unions are those of the transport trades; while the metal, mining, and textile trades come next. Italy occupies an exceptional position; for there just one-half of the organized workers are connected with agriculture. Anything like complete figures as to the financial condition of the Unions in different countries, are not forthcoming; but it is pointed out that large invested funds appear to be the exception.

On the subject of conciliation and arbitration, the report remarks that the institution by statute of public methods of conciliation and arbitration for the settlement of industrial disputes is of comparatively recent date, and the methods devised must still be regarded as tentative and experimental. The voluntary Boards of Conciliation and Arbitration which play so large a

part in the settlement of industrial disputes in the United Kingdom hardly exist in foreign countries; but the report contains a good deal of information as to official systems in operation in different countries. In Germany, there are two kinds of conciliation tribunals. The most important is the Industrial Courts, which have by law to be formed in all towns of over 20,000 inhabitants, and may be instituted elsewhere at the option of the government or on the requisition of a sufficient number of employers or workpeople. These Courts, which are elected by employers and employees, fulfil various functions; and among other things, they act as formal Boards of Conciliation and Arbitration, in cases of actual or impending strike or lock-out. The methods of action are clearly laid down; and that the Courts—of which there were 411 in Germany at the close of 1905—are capable of effecting much good work, is proved by the fact that during the last five years they have settled 51 per cent. of the disputes referred to them. Turning to France, we find that the local Magistrate is the chief medium of conciliation; he being empowered to form a Committee, on the petition of either of the disputing parties, or to take the initiative himself. When conciliation fails, arbitration is suggested; but there is no compulsion at any stage of the proceedings. In a considerable percentage of cases the offer of mediation is refused—for the most part by the employers; but where Conciliation Committees are formed by consent of both sides, a successful issue is reached in a large proportion of cases. In Belgium, the functions of conciliation and arbitration are exercised through local Councils established by the Government; and the communes bear the cost of their proceedings. In Holland, there are Chambers of Labour; the law providing for the establishment of these "where necessary and practicable." There were 90 of these Chambers in 1904; and they are composed of representatives of employers and workpeople, in equal numbers. Besides acting as Conciliation Boards, they perform various other duties with reference to employment. In the United States, industrial conciliation is regulated by State law; and considerable success has been attained by the various Boards which have come into existence. These statistics generally afford considerable ground for congratulation.

The report also contains figures regarding workmen's insurance and co-operation. With regard to insurance against accidents, the principle of compulsion has been applied in Germany, Austria, Hungary, France, Italy, Denmark, Holland, Belgium, Norway, Luxemburg, and Finland; but while in most instances the range of occupations embraced is wide, in some it is restricted to one or two kinds of employment. Insurance against sickness is compulsory in Germany, Austria, and Hungary, for industrial workpeople generally; in France, in the case of miners; and in Belgium, for miners and seamen. The system of insurance against old age and infirmity is most developed in Germany, where legislation has been adopted which includes even domestic servants. In France and Belgium, seamen and miners are entitled to old age pensions, and in Austria and Hungary miners only.

INTERNAL-COMBUSTION GAS-ENGINES.

Investigation as to their Efficiency by a Committee of the Institution of Civil Engineers.

Some time ago the Institution of Civil Engineers appointed a Committee to enquire into, and report upon, standards of efficiency of steam-engines. This was followed by another Committee to make similar investigations for internal combustion engines—dealing principally, of course, with gas-engines. Professor W. C. Unwin, F.R.S., was the Chairman of this Committee, the other members of which were: Sir Alexander B. W. Kennedy, F.R.S., Captain H. Riall Sankey, Messrs. Dugald Clerk, H. L. Callendar, C. J. Wilson, A. G. Ashcroft, and J. W. Hayward. Professor W. E. Dalby acted as Honorary Secretary. Their final report on the matter submitted to them covers nearly fifty pages in the last-issued volume (CLXIII.) of the "Minutes of Proceedings" of the Institution. The preliminary report was given in the previous volume of "Transactions." Needless to say, the reports contain a great deal of most valuable information, of particular interest to makers of gas-engines. They will study the reports for themselves; but, without going into much detail of the calculations, tables, or experiments recorded, we propose to give to-day a general outline of the findings of the Committee.

The shorter preliminary report is in many respects more interesting than the final one. The former describes the principles on which the Committee proceeded, and gives the ideal standard of comparison sought after; the latter report deals almost entirely with actual results obtained at trials of three gas-engines at the works of the National Gas-Engine Company at Ashton-under-Lyne. What is the purpose of standards of efficiency of heat-engines? The answer to this question very naturally forms the opening sentence of the preliminary report. "Standards of efficiency of heat-engines are required to indicate the extent to which the heat supplied is utilized in producing mechanical energy in any given engine, and for the comparison in this respect of engines of different types and construction." It had been shown by the Steam-Engine Committee that the efficiency of these engines might be measured by the number of pounds of feed-water required, or better, the number of thermal units supplied, per I.HP.-hour, or per I.HP.-minute. In comparing steam and gas engines, it is necessary to state the relative efficiencies as a ratio, termed the absolute efficiency—that is, the ratio of work done to heat supplied. This may also be expressed thus—

$$\text{Absolute thermal efficiency} = \frac{\text{Heat converted into work}}{\text{Heat supplied.}}$$

For internal combustion engines, this would be expressed—

$$\text{Absolute thermal efficiency} = \frac{\text{Heat utilized}}{\text{Heat generated by combustion.}}$$

It is well known that a large part of the heat supplied is wasted. This waste is made up in two ways: (*a*) a portion depending on the available temperature range, and (*b*) a portion lost in consequence of defects of operation. The former loss is unavoidable; but as the latter is of great importance to engineers, it is useful to have a ratio comparing the heat actually utilized to that which an ideally perfect engine would have used. Thus taking an ideal Carnot engine as the standard, we get—

$$\text{Relative efficiency} = \frac{\text{Heat utilized}}{\text{Heat utilized in Carnot engine.}}$$

The Committee find that, as all the actions in gas-engines are different from those in steam-engines, different standards of comparison are required. The greater part of the heat supplied to the steam-engine is received at a constant higher temperature, and rejected at a constant lower temperature. Both these limits of temperature can be easily and directly observed. In gas-engines, however, neither the higher nor the lower temperature of the cycle can be directly observed. Additions of heat are made at a rising temperature; and a very small amount is added at the maximum temperature. Therefore, the report says, it is not desirable to take as the standard of comparison an ideal engine having the same temperature range. A note states that this range may be from 200° to 2800° Fahr., with a compression ratio of 5 to 1. The thermal efficiency of a Carnot cycle for this range would be 0·80, or twice the efficiency of the constant volume cycle for the same compression ratio.

Physical Constants for Gases.

Then comes another point of difference between the steam-engine and the internal combustion engine. The physical properties of the working fluid for the former are constant, depending only on pressure and temperature. The working fluid for gas-engines, on the other hand, is a mixture of varying composition. The annexed table is given as showing the densities of gases that are important in considering questions of gas-engine efficiency. In this table [p. 636], there is also combined another, giving the value of the constant c in the general gaseous equation,

$$Pv = \frac{P_o v_o}{T_o} T = cT$$

where P, v, T, are the pressure in pounds per square foot, specific volume in cubic feet per pound, and absolute temperature respectively; and P_o, v_o, T_o, are the same quantities at 32° Fahr. and 1 atmosphere. The constant c varies for different gases directly as v_o, or inversely as the density.

The calorific value is, of course, important; and the following approximate lower calorific values are given—that is, when the steam produced by combustion escapes as steam, carrying away its total heat of formation: For lighting gas, 600 B.Th.U. per cubic foot; for water-gas, 300 B.Th.U.; for producer gas, 150 B.Th.U.; for Mond gas, 140 B.Th.U.; for coke-oven gas, about 800 B.Th.U. Calculations then follow in the report to ascertain the weight of the cylinder contents, from which the temperatures at different points in the cycle can be calculated. Then the specific heat of gases at ordinary and high temperatures and pressures are examined into; the conclusion of the Committee being that "it is best in the present condition of knowledge to make use of the values which have been ascertained accurately at ordinary temperatures. If the specific heat does vary with the temperature, nevertheless instructive and, for practical purposes, trustworthy deductions can be made although the variation is neglected."

Standards of Thermal Efficiency of Gas-Engines.

The ordinary way of measuring the efficiency of gas-engines has been by the number of cubic feet of gas (at standard temperature and pressure) required per horse-power-hour. A more exact way, now that the calorific power of the gas can be so easily ascertained, is to state the thermal units required per horse-power-minute. This should be given for both brake and indicated horse power; also for full-rated horse power and for fractions of it, for the thermal efficiency varies with the amount of work done. The report suggests that by "full-rated horse power" should be meant 85 per cent. of the maximum load. There are four conditions that the standard engine of comparison should comply with, and they are stated thus: "(1) The reception and rejection of heat should take place as nearly as may be in the same way as in the actual engine. (2) There should be no heat losses due to conduction, radiation, leakage, or imperfect combustion. (3) Data for numerical evaluation of the standard should

TABLE I.—*Density of Gases and Values of Constant "c" in Gaseous Equation in Foot-Pounds per Degree Fahrenheit.*

—	At 32° Fahr. and One Atmosphere.*				Value of C Calculated from Value for Air Inversely as the Density.
	Specific Gravity. Air = 1.	Weight in Pounds per Cubic Foot.	Cubic Feet per Pound.	P_oV_o.	
Hydrogen	0·0693	0·00559	178·30	378,819	768·1
Oxygen	1·106	0·0895	11·17	23,710	48·0
Nitrogen	0·971	0·0786	12·71	26,990	54·6
Carbon monoxide	0·955	0·0773	12·94	..	55·5
Carbon dioxide	1·529	0·1238	8·08	17,145	34·7
Air	1·000	0·0810	12·35	26,214	53·2
Steam gas	0·622	0·0502	19·91	42,141	85·3
Marsh gas (CH_4)	0·562	0·0455	21·97	..	94·3
Ethylene (C_2H_4)	0·982	0·0795	12·58	..	54·0
Coal gas—Glasgow†	0·485	0·0393	25·47	..	109·2
,, ,, Gaslight and Coke Company†	0·410	0·0332	30·12	..	129·3
,, ,, South Metropolitan Gas Company†	0·354	0·0287	34·89	..	149·6
Mond gas, dry	0·808	0·0654	15·29	..	65·6
Producer gas	0·965	0·0781	12·80	..	55·0

* One atmosphere is taken at 14·7 lbs. per square inch, or 2116·3 lbs. per square foot. † These values have been taken from Frankland's table of 1882-4 merely to indicate the amount of variation which may be expected. The quality of gas in different places varies from time to time.

be ascertainable by simple measurements. (4) The expression for the efficiency of the standard should be a simple one."

Of ideal standard cycles, there are three symmetrical types, each of which is a cycle of maximum efficiency for the conditions assumed. First, there is the constant temperature type, in which the reception and rejection of heat take place at constant upper and lower temperatures. The Carnot cycle is an example of this. But it is unsuitable for internal combustion engines because the cylinder would have to be very large, unless worked with highly compressed working fluid. Secondly, there is the constant pressure type, in which the heat is received and rejected at constant upper and lower pressures. Examples of this are the Brayton and Diesel engines. The third type is exemplified by the Otto and Beau de Rochas cycles, and is the constant volume type, in which the heat is received and rejected at constant volume. In point of fact, only two types of internal combustion engines are in actual use, all ordinary gas-engines working on the constant volume cycle, while the Diesel oil-engine uses the constant pressure form.

The next question for consideration is the adoption of a standard working fluid for the standard engine. This is necessary, as the Committee are of opinion that uncertainty would result if the standard engine cycle had to depend on the knowledge of the physical constants of the mixture used. They, therefore, recommend that (for simplicity's sake) the standard engine should be taken to work with a perfect gas of the same density as air. After determining the quantitative conditions of the ideal cycle, its temperatures, and pressures, the standard engine of comparison is arrived at, which is, therefore, "a perfect air-gas engine operated between the same maximum and minimum volumes as the actual engine, receiving the same total amount of heat per cycle, but without jacket or radiation loss, and starting from one atmosphere and the selected initial temperature of 139° Fahr." The actual efficiencies of all ordinary gas-engines vary between 0·5 and 0·6 of the efficiency of the air-engine standard—depending upon the size of the engine, the good arrangement of the combustion space, and the perfection of the valve action.

The final report of the Committee, as we have already said, deals exclusively with the detailed facts and figures relating to the testing of three gas-engines at the National Gas-Engine Company's works. This mass of figures and recorded observations, however, are not of very great general interest, valuable though they may prove to be to those particularly concerned. The three engines were designed to work with equal compression ratios—roundly, 5½ to 1. The small engine was of 5 I.H.P.; the medium one of 25 I.H.P.; while the largest engine was rated at 56 I.H.P. The table below gives at half-load and at full load, or, more accurately, at the most economical load, the figures concerned in the comparison of these engines of such varying power with the standard ideal engine proposed in the preliminary report.

Calculated from the indicator horse power, the absolute thermal efficiency varies between 29 and 35 per cent. at full load, and between 28 and 32½ per cent. at half-load. The efficiency relatively to the standard air-engine varies between 58½ and 70½ per cent. at full load, and between 56·4 and 66·3 per cent. at half-load. The mean mechanical efficiency of the full-load trials is 88 per cent., and that of the half-load trials is 79 per cent.

Calculated from the brake horse power, the absolute thermal efficiency varies between 26·1 per cent. and 29·9 per cent. at full load, and between 22·4 and 26·7 per cent. at half-load. The efficiency relatively to the standard air-engine varies between 52·6 and 61 per cent. at full load, and between 45·2 and 54·5 per cent. at half-load.

A general description of the engines tested, and of the arrangement of the testing apparatus, follows in the report. Then the heat supplied by the gas, and the amount of the air supply are gone into; this being succeeded by an investigation into the heat taken away by the jacket-water and by the exhaust gases. This leads to the heat converted into work, with a consideration of that which is lost by radiation. Methods of obtaining the mechanical efficiency are examined, and the conclusion is arrived at that, "however carefully indicator diagrams are taken in gas-engine trials, they do not furnish as accurate a value of the mean indicator horse-power as has been generally supposed."

Heat accounts and heat balance-sheets are set out in detail in some appendices to the report, along with many other figures and observations of these exhaustive trials on the efficiency of gas-engines.

TABLE II.—*Thermal and Mechanical Efficiencies.*

Designation of Engine.	Small.		Medium.		Large.	
	Half Load.	Full Load.	Half Load.	Full Load.	Half Load.	Full Load.
Indicated horse power	3·6	5·72	14·5	25·9	34·1	56·3
Brake horse power	2·87	5·20	10·82	20·9	27·9	52·7
Mechanical efficiency	0·80	0·90	0·75	0 80	0·82	0·94
British thermal units per hour, equivalent to the I.H.P. × 2545	9,166	14,557	36,902	65,915	86,784	143,283
British thermal units supplied per hour reckoned on the lower calorific value	32,260	49,630	117,200	187,700	267,500	450,600
Absolute thermal efficiency reckoned on I.H.P.	28·0 p. ct.	29·0 p. ct.	31·5 p. ct.	35·0 p. ct.	32·5 p. ct.	31 8 p. ct.
Absolute thermal efficiency reckoned on B.H.P.	22·4 p. ct.	26·1 p. ct.	23·6 p. ct.	28·0 p. ct.	26·7 p. ct.	29·9 p. ct.
Thermal efficiency of air, standard engine	0·496	0·496	0·496	0·496	0·49	0·49
Relative efficiency from I.H.P.	56·4 p. ct.	58·4 p. ct.	63·5 p. ct.	70·6 p. ct.	66·3 p. ct.	65·0 p. ct.
,, ,, ,, B.H.P.	45·2 p. ct.	52·6 p. ct.	4·76 p. ct.	56·4 p. ct.	54·5 p. ct.	61·0 p. ct.
Gas per I.H.P.-hour, cubic feet	15·78	15·33	13·77	12·78	13·67	13·94
,, ,, B.H.P.-hour, cubic feet	19·80	16·87	18·45	15 84	16·70	14·90
Ratio by volume of air to gas in explosive charge	8·49	9·15	8·42	9·17	7·97	8·27

Corrosion of a Brass Gas-Pipe.—Writing in the "Electrical Review," "E. G." says: "In searching for an escape of gas under a floor, we found it in a ⅜-in. brass tube, where it crossed a Simplex conduit tube carrying the cable for a few electric lights. The top of the brass tube was covered with verdigris for about 6 inches, and a small slit was in the tube from which the gas escaped. The distance between the two tubes was about 1 inch, and they have been in the same positions under the floor for about six or seven years. We were wondering if it was possible that a chemical action had been set up by the nearness of the electrical tube, or whether it was simply a coincidence that this slit and verdigris should be just over the electric wire. If the former is the case, there is evidently a possible danger which must be taken into account, and which is well worth the notice of both electrician and gas-fitter. We should be glad to hear if any others have had any similar experience."

REMOVAL OF TAR FROM WATER GAS.

At the last meeting of the Western (U.S.A.) Gas Association, the following paper on the above subject was read by Mr. E. H. Earnshaw, of Cincinnati (Ohio).

All who have engaged in the manufacture of carburetted water gas are familiar with the difficulty of completely and cheaply removing the last traces of tar before the gas reaches the purifier-house. The oxide in the boxes is a very efficient tar-extractor, but with results disastrous to its normal functions as a purifying agent. Much water-gas oxide is discarded more because of the tar it has absorbed than on account of the sulphur it contains. Many devices have been employed to remedy this evil; the most common being shaving scrubbers placed before the purifiers, or else an extra layer of shavings below the oxide in the boxes. There are serious objections to both methods. The shaving scrubbers affect the illuminating power of the gas and are expensive to fill and empty; while the layer of shavings in the boxes is only partially efficient, and reduces their capacity. The ordinary Pelouze and Audouin tar-extractor, as used for coal gas, has never proved a success with water gas.

Several years ago, while employed in the Philadelphia Gas-Works, we found it desirable to increase the temperature of the gas at the inlet of the purifiers to about 110° Fahr.; and the amount of tar deposited in the oxide became so considerable that it was determined to make a systematic effort to find some good way of removing it before the gas reached the purifiers. The impingement method of tar removal, as exemplified in the Pelouze and Audouin apparatus, seemed to be right in theory; so our experiments were directed to determine why this form of apparatus had hitherto been unsuccessful, and, if possible, to design a water-gas tar-extractor that would work. With this object in view, I designed an experimental apparatus constructed so that the number of impingement plates could be varied, as well as their distances apart and the diameter of the holes in the plates. Pressure gauges suitably located showed the loss of pressure in passing through the apparatus, and drip-pipes between the perforated plates enabled us to draw off and measure the tar and water condensed. This little apparatus proved very well adapted to its purpose. The perforations were arranged so that the gas passing through any plate impinged on the blank half of the plate next in series.

Our first experiments with this apparatus were designed to determine the rate of flow per hole for different losses of pressure and for different sized holes. We then made a series of experiments to ascertain the efficiency of small holes with plates close together, compared with larger holes and the plates wider apart. We were led to the conclusion that entirely satisfactory results could be obtained with holes $\frac{1}{8}$ inch in diameter and plates fixed $\frac{3}{4}$ inch apart, with great advantage over small holes and narrow spacing in lessening the chances of the apparatus clogging and giving greatly increased capacity per hole. The quantity of gas passed per hole per plate at 1 inch loss of pressure was $2\frac{1}{2}$ cubic feet per hour for $\frac{1}{16}$-inch holes in plates spaced $\frac{3}{8}$ inch apart, and 15 feet per hour for $\frac{1}{8}$-inch holes in plates spaced $\frac{3}{4}$ inch apart. Our subsequent experimenting, therefore, was with an apparatus arranged for a series of plates $\frac{1}{16}$ inch thick, having twelve $\frac{1}{16}$-inch diameter holes drilled in half of each plate. The plates were spaced $\frac{3}{4}$ inch apart, and the gas passing through impinged on the blank half of the next plate.

Our preliminary experiments also developed the idea that the removal of tar from water gas could be accomplished by a sufficient number of successive impingements. To determine the number of plates required and the most efficient velocity under different conditions, the apparatus was first set up at the inlet to the centre seal of No. 2 purifying-house at the Point Breeze Gas-Works. The temperature of the gas at this point varied from 105° to 110° Fahr.; and the amount of tar in the gas was sufficient to quickly saturate paper held in the stream of gas issuing from a pet-cock, and showed in the air as visible tarry vapours.

In the appendix will be found a summary of all the experiments, and I will refer to them by numbers. With three plates in series, experiments were made with rates of flow corresponding to $\frac{1}{2}$ inch, 1 inch, and 2 inch loss of pressure per hole per plate (Nos. 1, 2, and 3); but it was evident that the tar was not completely removed. The number of plates was increased to five (Nos. 4, 5, 6, and 7); but the results were still not satisfactory, as a large quantity of condensed tar was found in the meter after each test, and the gas issuing from the test-cock on the outlet of the apparatus would stain paper. Considerable variation in the amount of tar in the gas was noted from day to day, and judgment based solely on the quantity removed would be misleading. With nine plates in series (Nos. 8 and 9), the removal of tar was found to be reasonably complete; the temperature of the gas ranging from 105° to 110° Fahr.

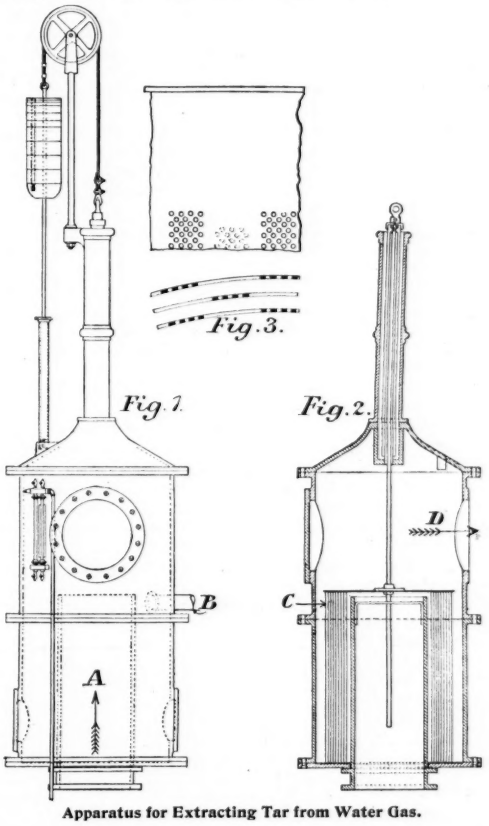
In order to study the removal of tar at higher temperatures, the apparatus was moved to the inlet of the condensers; the temperature at this point being about 175° Fahr. The amount of tar taken out by the apparatus was insignificant (No. 10)—very much less than was removed at the inlet to the purifiers, though the total tar in the gas at the inlet to the condensers must necessarily have been many times as great. The result at this point showed so conclusively that further cooling would be necessary before any attempt to remove tar would be successful, that no further experiments were made, and the apparatus was moved to the outlet of No. 6 condenser.

By controlling the temperature of the gas passing through this condenser, we were able to note the effect of successive reductions in temperature, starting at 160° Fahr. and dropping 10° at a time (Nos. 11 to 20 inclusive). There was a remarkable uniformity in the total amount of tar removed at each reduction in temperature; but in all cases a very considerable amount of tar passed the apparatus, and escaped into the air as visible tarry vapour. There was also a large condensation of tar and water in the dry meter used for measuring the gas. When the temperature reached 110° Fahr., the same as at the inlet to the purifiers, the results obtained were very inconsistent (Nos. 21 to 33 inclusive). At times the tar was completely removed, but at others a large amount passed the apparatus and collected in the meter. Different rates of flow were tried; but the variable results continued. It was noted that while the temperature was the same as at the inlet to the purifiers, the total quantity of tar carried with the gas was very much larger—thus demonstrating the great value of the relief holder in the removal of tar. This holder also seems to have an effect on the remaining tar, so that its removal by an impingement apparatus is comparatively easy.

The experiments at the outlet of the condensers were continued by increasing the number of plates to fourteen; the necessary velocity of flow being induced by a steam exhauster in the outlet-pipe from the meter. Beginning at a temperature of 130° Fahr., successive reductions of 10° were made (Nos. 34 to 45 inclusive). The tar removed by the last five plates increased as the temperature was lowered, until at 110° Fahr. the quantity left in the gas was quite small. At the temperatures of 100° Fahr. and below, the removal of tar was fairly complete. The apparatus was then moved back to the inlet to the centre seal of No. 2 purifying-house, and again it was found that nine plates in series were sufficient to completely take out the tar.

During the course of these tests, careful observations were made to determine the best rate of flow; and it was decided that a rate corresponding to a loss in pressure of 1 inch per plate was about the most efficient and desirable.

The experiments described extended over a period of about six months, and were considered to be so conclusive that a tar-extractor was designed and built embodying the principles as determined. The results obtained were entirely satisfactory, and a number of extractors have since been installed in different gas-works with gratifying success. In the accompanying illustration is shown the apparatus as now built; fig. 1 being a side view, fig. 2 a sectional elevation, and fig. 3 a diagram showing the arrangement of the baffle-plates. It is 3 ft. 6 in. in diameter, and has a capacity of 6 million cubic feet per 24 hours.



Apparatus for Extracting Tar from Water Gas.

It will be noted that the design is extremely simple, and affords large capacity with a small diameter of drum. A tar overflow-pipe B is shown; but in many cases the gas inlet-pipe A may be conveniently made to also serve the purpose. This is especially

the case when the extractor is placed between the relief holder and the exhausters, and the tar flows back to the outlet drip of the holder. The gas leaves the apparatus at D. Each plate contains the same number of perforations, arranged in vertical bands with blank spaces between, so that the gas passing through the holes in one plate impinges on the blank spaces of the next.

It is important to observe in this connection that the perforations in the outer plate C begin at the level of the tar overflow B, and those in the next plate 1 inch below it, and so on for each plate; so that the perforations on the inside plate begin 8 inches lower than those on the outside plate.

We have in Cincinnati a water-gas tar-extractor of this design, and Pelouze and Audouin condensers of the usual type for coal gas. The character of the tar removed from the water gas by the extractor is essentially different from that of the tar removed from the coal gas by the Pelouze and Audouin condenser; and an examination of these tars shows clearly why the water-gas tar is so much more difficult to remove. In the following table are given the results of analytical tests applied to tars collected from the overflows of the water-gas tar-extractor and the Pelouze and Audouin condenser respectively. The temperature of the water gas at the extractor is quite low, because the relief holder is large for the quantity of gas being made.

Analyses of Water-Gas and Coal-Gas Tars.

	Water-Gas Tar.	Coal-Gas Tar.
Temperature at extractor . . .	75° to 80° F.	95° to 100° F.
Water in tar, per cent. by volume .	4·67	19·82

Analysis of Dry Tar.

	Water-Gas Tar.	Coal-Gas Tar.
Specific gravity	1·02	1·17
Free carbon, per cent. by weight	1·65	21·47
Pitch, per cent. by weight	26·34	58·46

It will be noticed that the coal-gas tar is heavier, and contains more water and pitch, than the water-gas tar; and the quantity of tar oils obtained on distillation is very much less.

To determine the practical efficiency of the water-gas tar-extractor in actual operation, the following experiments were made at the West End Gas-Works in Cincinnati after the paper was written. Two U-tubes were filled with cotton and carefully weighed. The tubes were then connected at the inlet and outlet of the extractor, and gas allowed to flow simultaneously through the tubes; the quantity passed through each tube being measured by a test meter. The cotton in the tubes absorbed all the tar and water carried in the gas as mist; and the increase in weight of each tube showed the weight of tar and water present in the gas at the inlet and outlet of the extractor respectively.

Experiments Nos. 1, 2, and 3.—In these experiments, the U-tubes were immersed in a bath of water maintained at a temperature 5° Fahr. higher than that of the gas, in order to prevent condensation of tar and water vapour. The first U-tube was placed directly at the inlet to the extractor; but as the pressure at the outlet was less than that of the atmosphere, the second U-tube was fixed at the outlet of the exhauster.

—	Experiment No. 1. [April 12, 1906.]		Experiment No. 2. [April 13, 1906.]		Experiment No. 3. [April 14, 1906.]	
	Inlet.	Outlet.	Inlet.	Outlet.	Inlet.	Outlet.
Temperature of gas .	71° F.	80° F.	72° F.	77° F.	73° F.	82° F.
,, water bath .	76° ,,	85° ,,	81° ,,	86° ,,	78° ,,	87° ,,
Gas passed, cub. ft. .	20·5	21·5	22·4	23·0	41·8	42·6
Rate per hour . .	8·2	8·6	11·2	11·5	9·8	10·0
Increased weight of U-tubes, gramme .	0·30000	0·03730	0·16980	0·01200	0·41990	0·04600
Gramme per cub. ft.	0·01463	0·00175	0·00758	0·00078	0·01004	0·00107
Efficiency of extractor	88·0 per cent.		89·6 per cent.		89·2 per cent.	

Experiments Nos. 4 and 5.—In these experiments the U-tubes were immersed in a water bath 10° Fahr. lower in temperature than the gas. In No. 4, no attempt was made to dry the cotton, and the heavy condensation of water destroyed any comparison. For some reason, the amount of condensation was greater at the outer than at the inlet of the extractor. In experiment No. 5, the U-tubes were filled with cotton, and then dried at 220° Fahr. to constant weight. After passing gas through them, they were again dried at 220° Fahr. to constant weight, and the increase in weight therefore represents only the tar that was present in the gas.

—	Experiment No. 4. [April 16, 1905.]		Experiment No. 5. [April 18, 1906.]	
	Inlet.	Outlet.	Inlet.	Outlet.
Temperature of gas. . . .	68° F.	72° F.	68° F.	76° F.
,, water bath	58° ,,	62° ,,	58° ,,	66° ,,
Gas passed, cub. ft.. . . .	29·8	34·8	34·9	33·0
Rate per hour	7·4	8·7	8·2	7·7
Increase in weight of U-tubes, grammes	1·6858	2·8490	0·917	0·068
Gramme per cubic foot . .	0 05657	0·08189	0·02627	0·00206
Efficiency of extractor . .	. . . . 92·15 per cent.			

[Appendix.]

Summary of Results of an Investigation into the Removal of Tar and Water from Water Gas.

[In Experiments Nos. 1 to 9, the apparatus was located at the inlet to the purifier-house; in No. 10, at the condenser inlet; in Nos. 11 to 45, at the condenser outlet; and at Nos. 46 and 47, at the purifier inlet.]

Exp. No.	Temperature of Gas. Inlet.	Temperature of Gas. Outlet.	Press. Lost per Plate. Inch.	Flow of Gas per Hole per Hour. Cubic Feet.	Amount of Tar Removed. Gallon per 1000 Cub. Ft. Plates 1 to 3.	Plates 4 to 5.	Plates 6 to 9.	Plates 10 to 14.	Total Condensation. Gallon per 1000 Cubic Feet. Tar.	Water.	Total.
1	105 to 110	..	1/32	9·6	·0230	..	..	..	·023	·016	·039
2		..	1	14·8	·0240	..	..	..	·024	·016	·040
3		..	2	23·0	·0240	..	..	..	·024	·021	·045
4		..	1/32	9·9	·0240	·0080	..	..	·032	·031	·063
5		..	1	15·3	·0260	·0040	..	..	·030	·027	·057
6		..	2	23·8	·0210	·0050	..	..	·026	·025	·051
7		..	1	15·1	·0134	·0103	..	..	·0237	·0310	·0547
8		..	1	16·4	·0128	·0056	·0052	..	·0236	·0313	·0549
9		..	1/32	12·7	·0181	·0050	·0035	..	·0266	·0359	·0625
10	175	167	1/32	11·6	·0069	·0053	·0155	..	·0307	·1710	·2010
11	160	158	1/32	9·2	·0234	·0246	·0281	..	·0761	·0848	·1610
12	160	158	1/32	10·1	·0195	·0214	·0235	..	·0640	·1360	·2000
13	150	146	1/32	7·3	·0363	·0283	·0308	..	·1049	·1479	·2529
14	150	146	1/32	7·2	·0268	·0257	·0272	..	·0798	·1100	·1936
15	140	136	1/32	8·6	·0178	·0270	·0360	..	·0861	·0995	·1856
16	140	136	1/32	7·6	·0173	·0337	·0294	..	·0949	·1110	·2060
17	130	126	1/32	8·1	·0203	·0248	·0386	..	·0839	·1095	·1935
18	130	126	1/32	7·3	·0241	·0353	0465	..	·1059	·0589	1649
19	120	116	1/32	6·7	·0241	·0251	·0335	..	·0929	·0843	·1775
20	120	116	1/32	6·4	·0279	·0309	·0408	..	·1100	·0597	·1697
21	110	105	1/32	7·1	·0277	·0279	·0636	..	·1134	·0384	·1519
22	110	105	1/32	7·0	·0453	·0347	·0545	..	·1317	·0410	·1727
23	110	105	1	9·7	·0161	·0175	·0248	..	·0696	·0584	·1279
24	110	105	1/32	9·5	·0241	·0294	·0441	..	·0966	·0489	·1455
25	110	105	1	10·8	·0134	·0155	·0404	..	·0693	·0498	·1191
26	110	105	1	12·3	·0123	·0171	·0345	..	·0641	·0305	·0946
27	110	105	3/16	3·7	·0258	·0327	·0312	..	·1097	·0884	·1942
28	110	105	3/16	3·0	·0331	·0211	·0293	..	·0838	·0770	·1608
29	110	105	3/16	3·2	·0172	0143	·0209	..	·0528	·0540	·1068
30	110	105	1	10·5	·0224	·0251	·0501	..	·0978	·0408	·1383
31	110	105	3/16	3·0	·0271	·0248	·0384	..	·0906	·0718	·1623
32	110	105	1	8 1	·0382	·0339	·0466	..	·0929	·0656	·1585
33	110	105	3/16	2·4	·0364	·0355	·0208	..	·1191	·0772	·1971
34	130	123	1/32	11·6	·0269	·0266	·0536	·0131	·1205	·0589	·1794
35	130	121	1	13·4	·0216	·0157	·0420	·0187	·0981	·0682	·1660
36	130	123	1/32	12·2	·0221	0280	·0272	·0156	·1030	0655	·1685
37	130	121	1	16·9	·0348	·0175	·0344	·0225	·1096	·0558	·1653
38	120	117	1	15·1	·0251	·0208	·0459	·0160	·1081	·0635	·1716
39	110	104	1	9·6	·0285	·0184	·0535	·0540	·1493	·0873	·2366
40	110	102	1/32	13 3	·0235	·0136	·0199	·0441	·1312	·0565	·1879
41	100	94	1/32	12·6	·0168	·0209	·0515	·0221	·1115	·0517	·1632
42	100	95	1	14·3	·0300	·0196	·0461	·0301	·1261	·0517	·1778
43	100	94	1/32	10·2	·0251	·0301	·0571	·0092	·1267	·0598	·1866
44	100	94	1	13·8	·0458	·0384	·0553	·0080	·1479	0555	·2034
45	90	87	1	14·0	·0331	·0284	·0416	·0312	·1337	·0398	·1735
46	111	106	1/32	17·2	·0076	·0012	·0010	·0008	·0111	·0319	·0430
47	108	103	1	16·7	·0138	·0033	·0012	·0016	·0195	·0277	·0472

In a second appendix, the author gave details of certain of the experiments summarized in the preceding table.

The paper gave rise to a short discussion, which was opened by the Secretary reading a communication from Mr. H. C. Abell, of Muskegon, as follows: I have tried various experiments to remove tar from water gas, many of which were suggested and under the direction of Mr. Henry L. Doherty. These experiments consisted of various mechanical appliances, such as sawdust scrubbers, washer-scrubbers, and also by the use of a screw with a large diameter core around which the gas flowed, thereby increasing the peripheral velocity of all the gas, and throwing the tar off. The screw tar-extractor did fairly good work with temperatures at about 120° Fahr. I also obtained fairly good results with a form of sawdust scrubber without seriously reducing the candle power of the gas. I also conducted experiments to minimize the amount of tar made per gallon of oil used in the machine by trying various temperatures in the machine and various lengths of time of running, also with different forms of sprays. When trying to minimize the amount of tar made in the machine, there are so many variables to be considered, many of which are almost impossible to obtain, that it is very difficult to repeat results. In the first place, the oils have not the same specific heat, the same latent heat of vaporization, or the same specific heat of the gas made from the oil. Then the chequer brick of the machine is also a variable; some bricks having different specific heats from others. There are no data to be obtained which give any approximation whatever as to how effective the heating surface of a brick is—in other words, how quickly heat from the interior of the brick is conducted to the surface so as to make it effective in gasifying the oil. The temperatures are also difficult to obtain. I tried less chequer brick in the carburettor—vaporizing the oil into the blue water gas, so that the small oil particles or oil vapours were practically occluded in the blue water gas, and found that the yield of gas of high illuminating and calorific value increased very materially. The make of lampblack was decreased, and the percentage of tar very materially so. I note in the paper that at the inlet of the condenser, the gas being 175° Fahr., a very small amount of tar was taken out. This I think is due to both

the pressure and the temperature, or, in other words, to the vapour tension; and for us to eliminate tar from the gas most effectively, it means that we have to know more or less about vapour tensions, and also about the oils we use, in order to make as little tar as possible, and also to know at what temperatures the different constituents in the tar are condensed and can be taken out.

The first speaker was Mr. V. L. Elbert, who spoke highly of the care with which Mr. Earnshaw had prepared his paper. He said he believed it was generally conceded that the maximum quantity of tar produced in making water gas was 0·65 to 0·7 gallon for each 1000 cubic feet of gas made. In experiments Nos. 12 to 42 inclusive, the average tar extracted by the apparatus was less than 0·1 gallon of the total tar produced. The remaining 0·6 gallon was evidently removed by the relief holder and the condenser. The author called attention to the great value of the relief holder in the removal of tar; and as it did this, and was also a good condenser, there was practically no need for water-cooled condensers. But the apparatus should be so modelled as to remove all the tar, and not only 0·1 gallon per 1000 cubic feet. He found at their plant that, with a tar-extractor they built themselves, practically all the tar could be removed from the gas at or near 90° Fahr. At a temperature of 100° or over, naphthalene crystals could free themselves from the tar; and for this reason he preferred to keep the tar-extractor at or near 90°. They had no trouble with tar in their purifying material; and they had some boxes that had been in use more than a year without changing. He would like to ask Mr. Earnshaw why they kept the temperature of the purifiers at 110° Fahr. He supposed they had some reason for it. He found that the boxes would do much better work, and last much longer at 74° to 76°. There was a danger, and a very serious one, of naphthalene being formed with this high temperature in the boxes; and it was apt to collect and get in the station meters and cause trouble—at least, this had been his experience. He admitted that a little higher temperature would purify more gas; but he did not think it advisable to carry over 74° to 76° Fahr.

Mr. F. Egner pointed out that there was nothing particularly new in Mr. Earnshaw's troubles, as related in his paper. Gas managers had had them long ago, and had overcome them. Mr. Earnshaw's principal difficulty seemed to have been that he found it necessary to raise or maintain the temperature of the raw gas at 110° Fahr. to the inlet of the purifiers. He (Mr. Egner) could infer why this was done; but he hoped the author would tell them, for the paper did not appear to point out this not uninteresting item. They were told that the raw gas was carried at a temperature of 110° Fahr. to the inlet of the purifiers; and then they were surprised to find the purifying material soon fouled by particles of tar, which naturally had not been removed by the insufficient condensing arrangements—insufficient perhaps only under the prevailing conditions. Mr. Earnshaw had pointed out that his relief holder acted in a measure as a condenser, as many others had found, on occasion. In the days before they had a relief holder in water-gas making, it was customary to put a layer of shavings or sawdust under the purifying material; and this could remain in the boxes over three or four changes. After the relief holder was introduced, while shavings were still used at some works, they would last much longer. If Mr. Earnshaw had not laboured under the difficulty of having to bring up or maintain his gas at the temperature named at the inlet of the purifiers, he probably would not have had any trouble, as a little more cooling of the gas would, of course, have precipitated all the tar before the purifiers were reached. He commended the paper earnestly to the attention of the younger gas engineers, as he considered it worth studying and thoroughly digesting by the rising generation. The principal value of the paper to the older engineers was, in his opinion, that Mr. Earnshaw showed them a way to maintain the raw unpurified gas at 110° Fahr. to the inlet of the purifiers, and still take out all the tar.

Mr. Macbeth thought that it would be interesting, in connection with the paper, if he related what an old Pelouze and Audouin tar-extractor was doing for his water gas. They had been using it for some time, and they knew they were taking out a good deal of water and some tar; but he did not know how much. He had the condensation measured for a couple of days, for two hours each day, and ascertained that he was taking out 0·4 gallon of water and tar per 1000 cubic feet of gas passed. He distilled this, and found that 96 per cent. of the mixture was water and the other 4 per cent. tar. The temperature of the gas at the extractor was 130° Fahr. This might seem high; but the machine was located on the outlet of the condensers, and there were some condensers on the other side, which would bring the temperature down a good deal lower before the gas went to the purifying-house.

Mr. Waring remarked that Mr. Earnshaw had brought out the point that a water-gas Pelouze and Audouin condenser would not work where the temperature was very high—that was to say, it would not work where they now had the tubular condenser. He asked Mr. Earnshaw if they had not got this condenser in the wrong place. Some one suggested that they should do away with a tubular condenser. Why not put it on the outlet of the relief holder instead of on the inlet, and do the same with the scrubber?

In replying upon the discussion, Mr. Earnshaw said, in answer to Mr. Elbert's question as to why the temperature of the gas was raised at the purifier, that, of course, was for manufacturing reasons; but it would require a long explanation to go into it fully, and it would have no bearing on the present question. He did not mean to infer that trouble with the tar reaching the purifiers only appeared when the temperature was raised at the inlet of the purifiers, as it always existed; but with the rise in the temperature of the gas the amount of tar increased, so that the difficulties urgently required relief. This was the more immediate reason for undertaking the experiments. They never experienced in Philadelphia any naphthalene troubles on account of carrying gas at a high temperature to the purifiers, though he could imagine that it might exist under some conditions. Mr. Egner's remark that the extractor would not have been needed if they had not raised the temperature, he had answered in replying to Mr. Elbert. The relief holder was very large for the quantity of gas they were making; so that the temperature was not more than 75° Fahr. at the extractor. He would not attempt to enter into a discussion as to the proper place for the condenser and the relief holder and the scrubbers, as it was too large a question.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Visit to the Birkshall Gas-Works, Bradford.

Notwithstanding that many of the members were away on their holidays, and that the exceptional heat of the day impelled to green fields and woods rather than to retort-houses, a large number of the members of the Yorkshire Junior Gas Association assembled on Saturday last at the Birkshall Gas-Works of the Bradford Corporation. The President (Mr. E. J. Sutcliffe) is Superintendent of these works, and, on being asked to arrange for an Association visit, he suggested a departure from the ordinary routine, which was accepted with alacrity. This was that the visit should be timed for the annual shutting-down of the entire works for repairs, &c. Many of the members had already been through the works during the period of normal working, and to few would that working reveal any very notable features not seen elsewhere. The opportunity, however, of seeing a 600 million cubic feet works shut down, with every piece of the plant open for full inspection, was quite exceptional, and was a privilege to be eagerly embraced. The Chief Engineer of the Corporation Gas Department (Mr. Charles Wood, F.C.S.), glad to give this tangible proof of his interest in the work of the Junior Associations, readily and kindly consented to the arrangement.

The officials of the Association had prepared a full description of the works, and had indicated the various points of educational interest; and a type-written copy was supplied to each visitor. Questions were showered upon the guides; and at the close of the visit, many were again taken to special parts they wished to re-examine, or to parts that, on the interchange of opinions over the tea-table, had been found to have been imperfectly seen or understood. Mr. Sutcliffe was assisted in the work of showing the visitors round by Mr. H. Akam and Mr. W. J. Dowse, the Superintendents of two of the other Bradford works. That the special purpose of the visit was amply fulfilled was very evident from the minute thoroughness of the inspection, and from the grateful remarks constantly being heard, as well as from the formal speeches of appreciation and thanks at the close.

Bradford has eight gas-works, four of which have been bought from surrounding local authorities or companies in recent years. These are all so coupled up that any can be completely shut down for cleaning and repairs during the summer. From all of them the ammoniacal liquor is run by gravitation through pipes to the Corporation's chemical works at Frizinghall; the tar being sold and dispatched to the distillers from each works independently. Six of the works do thus suspend operations for a period each summer; while the other two, consisting in one case of two and in the other of three independent and complete sections, close down part of their plant at a time.

Birkshall is the second largest of the Bradford works; its yearly make being 600 million cubic feet out of the total of 2036 millions. The plant is throughout equal to a daily output of at least 2½ millions; the storage capacity being just a little short of this. A considerable increase in the production of these works will be arranged for at some future date, consequent not only on the consumption of gas overtaking the full capacities of the combined works, but on the closing of at least one of the older works which will in all probability eventually occur. In readiness for this, the shell of a second retort-house equal in dimensions to the existing one has been erected by its side; and an extension of the holder accommodation is also talked of.

The works are in close proximity to the Lancashire and Yorkshire and Great Northern Railways; and both lines communicate with the works sidings. Part of these are alongside the retort-house, and at a lower level. While convenient for dealing with the coke, it means a stiff gradient before the coal waggons can reach the gantries along the retort-house. The coal is therefore brought by the works locomotive by a more circuitous path round the yard, past the open-air coal-stores and tar-discharging pumps, to the level from which it is discharged into the breaker pits. There are two of these on each side of the retort-house, and from them the coal is raised by bucket elevators to overhead hoppers, from which it is fed into West's machine chargers (cotton-rope driven). These hoppers are put at one end, and at

the middle of the house, because their individual capacity is equal to the charges of one tier of retorts along half the house. West's machine dischargers are also employed. Attention was called to the fact that the two settings at each end of the house could not be served by both machines, as is common in houses which were not primarily built with a view to the use of stoking machinery, especially if the end of the bench comes near to the end wall.

The retort-house is 320 feet long by 90 feet wide, and contains 40 through settings of fives (21 in. by 16 in. and 20 in. by 14 in.), all direct-fired. A large number of retort-setters and other workmen had been busily at work here; and the various parts of the carbonization plant and its accessories were seen in all stages of demolition and repair. Needless to say, this part of the progress round the works excited great interest, and took much time. Eight settings were being entirely renewed, and Mr. Sutcliffe had arranged that each setting should show a different stage of the dismantling. This enabled the construction to be easily grasped, and the various gas-travels to be traced. Search had been made for a good illustration of short-circuiting; and this had been so opened out that it could readily be examined and its cause surmised. The settings are thoroughly overhauled every summer, and retort-repairing is carried out very thoroughly. The lining of the furnaces is renewed, defective stretches of the retorts are cut out, and replaced by rebated bricks of various sizes and shapes made by the same firm who supply the retorts, and all cracks finally well cemented. The retorts can be repaired from both outside and inside; the outside of the lowest tier being reached from the furnace after the lining has been removed, and the two upper tiers by removing the ascension-pipes of the middle tier, and taking down part of the front wall and the upper parts of the buckstaves through the setting. A kind of regenerator arrangement has latterly been profitably incorporated into the setting. Air-inlets are provided below the fire-bars, and after several short travels the heated air emerges into the furnace above the level of the fuel. This was inspected with great interest; and much discussion was evoked as to the conditions affecting its working, since no ordinary regulation is possible.

The main flue along the bench top was formerly divided longitudinally into two passages communicating with the chimney. For some time the chimney has not been used, but openings have been made in the top of the main flue, one for each setting, and these have become practically separate chimneys. This main flue is now in course of being separated up into a series of dwarf chimneys—an arrangement which is easily carried out, as the waste-gas passage from the setting to the main flue comes up the middle of the piers between the settings.

The hydraulic main is in sections corresponding to five settings, the gas being taken off at one end and the tar and liquor at the other. The usual flushing accessories are provided, and, in addition, a liquor-pipe is inserted into the bend of the pipe leading from the gas take-off to the foul main. The periodical flushing of this part prevents accumulations which were formerly very troublesome. (These were thought to be a result of the cooling-down of these pipes consequent on the Sunday cessation of operations which is observed at the Bradford works.)

As the hydraulic main and all its connections are of cast iron, any rectification of levels is difficult. An attempt was being made to accomplish this over the eight settings which had finished their life of service; and the preparations for this work came in for a good share of attention. The condensers are of Clapham's "Eclipse" vertical multitubular water-cooled type. All the manholes were open. To make their examination the more profitable to any who were not very familiar with this type, blue prints or tracings were hung up on boards near the plant in this and almost every instance round the works.

The exhausters are Gwynne's form of the Beale type, and are in duplicate. One was opened out, and its various parts were closely examined, as perhaps of no piece of gas-works plant are the details of its internal arrangement and working so little known among the junior members of the staff as of the exhauster. The guiding of the blades by segments moving in races in the ends of the covers was of special interest to many who had not seen this form before. In addition to the ordinary water-column gauges and recording gauges, was an installation of Bristol's recording gauges. A Hohmann and Maurer's gauge was shown, and the readiness with which it could be read from a distance and in any part of the room was pointed out; the latter being no small advantage in so large a room as the one at Birkshall, where, as in other parts of the works, room is left for extensive future additions.

A Pelouze and Audouin tar-extractor of the "Improved Western" type, as made by Messrs. Holmes and Sons, of Huddersfield, was next visited. It is of 2½ million cubic feet per day capacity, and was fully opened out to view. To many of the visitors this was their first opportunity they had had of seeing inside so large a specimen, and the improvements and additions made since the original introduction of this machine were duly noted. The actual extractor is polygonal in section—6-sided—and is annular; the gas forcing its way inward and outward through four sets of perforated plates (slits and holes alternately), set with the blanks of one plate directly opposite the openings of the next. Four safety-valves are provided in this size, so that gas can pass even if the extractor be grounded from the snapping of the chain supporting it, &c. At Birkshall no difficulty is experienced in getting it to work smoothly, and to adjust itself automatically to the quantity of gas passing. To secure this, its bell is sealed in creosote to dissolve off the tar, and each month it is opened and the annular space brushed out with a brush dipped in creosote.

At Bradford, cyanide recovery is carried out by the Chance process. Gas which has not had its ammonia removed (except in the condensers) is washed in a special form of a Holmes washer-scrubber, with the addition of solid sulphur through valves into the tops of each section. The normal ammonium sulphide first formed combines with and dissolves the sulphur, forming yellow ammonium polysulphide solution; and this absorbs hydrogen cyanide gas, with the formation of ammonium sulphocyanide, which, when it reaches a certain concentration, is sold to the patentees of the process, and by them is worked up. Attention was called to the excessively corrosive action of this liquid, and its suspended sulphur on steel and wrought iron; the makers now using only cast iron in these machines, with the exception of the bolts and the central steel shaft, which, however, is protected by a collar of cast iron along its whole length. The way in which the friction of the solid sulphur destroys the brushes was plainly seen in the specimens on a waste heap; and the latest improvement was noted in the method of fitting in the brushes and fastening them, which is easily managed through a single manhole in each section. Unlike the ammonia washers of this firm, the cyanide washer is made without "still chambers," has two scrapers attached to each drum to stir up the sulphur which tends to remain deposited at the bottom, and in many cases has the liquor travelling in the same direction as the gas, and not opposite to it as is invariable in ammonia-washing. At Bradford this arrangement was formerly observed; but now, as a gas of adequate ammonia contents is brought to the washer-scrubber, the gas and liquor travel in the same direction (120 grains of ammonia per 100 cubic feet is about what is necessary). The washer-scrubber is of the newest form, with detached bearings. Two circular tower scrubbers (board filled), 52 feet high and 12 feet in diameter, one provided with a Walker washer, and one of Kirkham, Hulett, and Chandler's "Standard" rotary washers, complete the removal of the ammonia.

While examining these portions of the plant, much admiration was expressed at the great extent to which the mains and connections were clear above the ground, and at the custom observed throughout all the Bradford works of painting the name on every valve in large white letters, whether outlet, inlet, bye-pass, &c.

The purification plant did not need much notice, as it was of the usual type; and this branch of gas-works practice is not unfamiliar to the majority of the staffs of these establishments. One box was fitted with the Spencer "hurdle" grids.

The meter-house vividly brought to mind the possible future development of the works, as while provision is partly made for three station meters, only one is at present in position—one of Braddock's, of 3 million cubic feet per day capacity. Although the case had been opened at the top, and the manholes opened in the drum, the invitation to descend into the drum to examine its interior fell on irresponsive ears, and its construction taken for granted.

The two holders were not in course of repair or cleaning, but were full of gas. They have capacities of 1,380,000 and 980,000 cubic feet, and are each of two lifts. They stand in brick and puddle tanks, and their standards are of unusual massiveness, and are somewhat more numerous than those generally employed. It may be remarked, in passing, that the site is fairly exposed, and certainly no undue risks were incurred.

Though last in order of gas progress, the governors were by no means least in interest—in fact, to some this was the most interesting part of the plant. Two old governors had been taken out, and were being replaced by two of Braddock's new patent governors. A 36-inch main from the holders branches into two 28-inch mains on which the governors are fixed. The two mains supply different districts, though a bye-pass admits of both areas being supplied through either governor, as will have to be the case for a short time when gas making is resumed. One of these new governors was practically erected, but was entirely open, and could thus be inspected with the greatest ease and thoroughness. Ready comparison with the older governors was easy, inasmuch as these were in the yard near—one entirely taken to pieces, and the other partly put together again. There was considerable surprise at the great size of the old governors compared with the compactness of the new ones, which will be filled with water-loading arrangements.

The photometer-room, laboratories, &c., were outside the purpose of the visit as arranged, and were not specially noticed. The coke-breaking plant called forth the information that a large and satisfactorily remunerative sale of this broken coke for domestic use has been built up.

A special feature of these works is the splendidly equipped engineering shed, which serves for all the eight stations. A number of the employees were working overtime, so that all the machines were seen in operation; several being specially set on to show the nature of their work. Among them were four lathes (one for wood and three for metal), ordinary drills, one fitted with a multiplying arrangement so that a very high speed of drill is obtained, a radial drill, by which, as was shown, holes could be drilled at any angle, planing-machines, metal saws, emery wheels and polishing wheels, slotting-machines, and a powerful punching and shearing machine, in addition to the more ordinary gas-works appliances.

The visitors finally sat down to tea, which had been kindly

provided by the President in the offices of the works. The lively sense of gratitude to Mr. Sutcliffe which had been freely manifesting itself all the afternoon, was now formally expressed by Mr. G. W. Fligg and Mr. T. W. T. Hammerton in vigorous and happily chosen sentences. After which other votes of thanks were accorded to Mr. Dowse and Mr. Akam, who had assisted as guides, and to Mr. Charles Wood, the Chief Engineer, for his consent to the visit.

COAL-TAR PAINT.

The disposal of coal tar to the best advantage, and its utilization for purposes for which it has not hitherto been largely employed, are subjects which have been so much under consideration lately, that attention may be directed to some experiments bearing upon its use in the production of a protecting paint for ironwork. They were carried out by Mr. A. C. Cunningham, of the United States Navy, who, while on the New Orleans Naval Station, noticed that when the Southern Pacific steamers entered the port their hulls, from the water-line for a considerable distance up, were painted with ordinary coal tar. Further inquiry brought the information that tar was quite commonly used on the bottom of craft in the New Orleans section; and in the "Journal of the American Society of Naval Engineers" recently Mr. Cunningham gave some interesting particulars on the subject.

While the tar was under observation, a patented coal-tar paint was offered for sale on the station at 50 c. per gallon. It had the appearance of a high-grade asphaltum paint; but examination of the formula by which it was made showed that it consisted of coal tar with some twenty different substances added in various proportions, evidently in no scientific manner. The substances constituted two groups, one of which was a dryer and the other an acid neutralizer. With this information as a basis, and the tradition that lime would neutralize the acids in coal tar, which are supposed to be injurious to iron or steel, experiments were made to develop a paint, using turpentine as a dryer. They were a failure. It was found that the lime, whether quick or slaked, spoiled the mixture, and the result was a non-lustrous coating of no durability.

In the next series of experiments, portland cement was substituted for lime; the turpentine still being used. An improvement in results was secured, but the paint was not entirely satisfactory. At this stage of the proceedings, information was received that common kerosene oil would act as a dryer to coal tar. Further tests were started on this basis, and the desired results were reached.

The final mixture was tested by the Government Chemist at the Washington Navy Yard, and pronounced non-injurious to iron and steel. The tests of the mixture were carried still further by Mr. Cunningham while stationed at the Naval Academy, and a perfected method of mixing developed. The proportions of the mixture are slightly variable, according to the original consistency of the tar, the use it was intended for, and the climate in which it was to be used. In general, it will vary between the following proportions, by volume:—

	Coal Tar.	Portland Cement.	Kerosene Oil.
New Orleans mixture . .	8	1	1
Annapolis mixture . . .	16	4	3

The portland cement should be first carefully stirred into the kerosene oil, forming a creamy mixture. This mixture is then carefully stirred into the coal tar. To obtain the best results, it should be freshly mixed and kept well stirred.

With this tar paint, old leaky tin roofs at the Naval Academy, on buildings that were to be taken down in the course of two or three years, were made water-tight. On the worst places, a coat was applied; then muslin was stretched over the wet paint; and after drying an additional coat of paint was applied over the muslin. Temporary sheds that were covered with tin taken from the demolished buildings had their roofs made water-tight and sightly.

This coal-tar paint is the only mixture that Mr. Cunningham has ever found that will unquestionably stick to and thoroughly cover galvanized iron. The cost of the paint will vary from 10 c. to 15 c. per gallon; and when it is considered that even a fair linseed-oil paint will cost from 80 c. to $1 per gallon, the great economy is apparent. Linseed-oil paints have no durability in salt water or in a very salt atmosphere, on account of the solvent action between the salt and the linseed oil. The tar paint, however, being composed of purely mineral materials, is quite stable, and much more durable under the same conditions. The purity of paint materials is a subject in itself; but as regards the coal-tar paint, the materials are so inexpensive in themselves that no adulteration need be feared.

It goes without saying that a metallic surface that is to be painted should be as clean and free from scale as possible. New iron from a mill is generally painted too soon, as the mill-scale is very tenacious for a long time, but will ultimately come off and bring the paint with it. A rust-scale is as bad to paint over as mill-scale. A light newly-formed rust is not injurious to paint over, provided there is not too much for the paint to reach the metal proper. The theory that when any rusted surface is painted over, the oxidation will continue on into the metal without extraneous assistance, is, on the face of it, erroneous, as iron oxide is a very stable combination. The conditions for rusting require the presence of both air and moisture. In dry air or pure water, iron will not rust. Painting over a rust-scale ensures the contact of a porous layer containing both air and moisture against the pure metal; and rust-scales continue to form under the most favourable conditions until the swelling of the oxide causes the whole to fall off. The black surface which then appears is sometimes mistaken for the mill surface of the metal.

Mr. Cunningham does not make any unusual claims for coal-tar paint; but he believes that it is better than most cheap paints of unknown origin and materials. It has been sufficiently demonstrated that it is of some value; its low cost is attractive; and in emergencies it might be of great use.

OBITUARY.

In the report presented at the recent annual meeting of the Brymbo Water Company, the Directors stated that they regretted that since the issue of the previous report they had sustained a serious loss in the death of Mr. J. C. GITTINS, the Deputy-Chairman, whose services were enthusiastically devoted to the Company for upwards of ten years, and also in the death of their Engineer, Mr. HENRY DENNIS, who had been connected with the undertaking, much to its advancement, since the foundation of the Company.

Mr. J. B. TERRACE, who was for years Manager of the Brechin Gas Company, was accidentally killed in the works of Messrs. W. Wilson and Co., boilermakers, Tollcross, Glasgow, on Thursday last. On leaving Brechin, about eight years ago, Mr. Terrace went to reside in Glasgow, where he was employed as draughtsman in large engineering works. He was a native of Dysart, in Fifeshire, and was 57 years of age. Two of his brothers are Gas Managers — Mr. David Terrace at Middlesbrough, and Mr. Andrew Terrace at Blairgowrie.

The death is announced, in his 76th year, of Mr. CHARLES DENTON ABEL, of Messrs. Abel and Imray, Patent Agents. Deceased was brother of the late Sir Frederick Abel, and was educated at the Government Engineering College, Carlsruhe. On returning to England, he became associated with Mr. Edward Cowper, a well-known patent agent of the time, on whose death Mr. Abel purchased the business, and in 1871 took into partnership the late Mr. John Imray. Mr. Abel did much to further improvements in patent law, and as early as 1865 he read a paper before the Society of Engineers on the subject. His latest communication was one read before the Society of Arts in 1904, on the Patent Act of 1902. For this he was awarded the Society's medal. He was one of the founders of the Chartered Institute of Patent Agents, on the Council of which body he served from its foundation in 1881; and he was President from 1897 to 1899 inclusive. He was an associate of the Institution of Civil Engineers, and a member of the Institution of Mechanical Engineers.

A prominent Yorkshire coalowner and citizen of Leeds has just been removed in the person of Alderman ARTHUR CURRER BRIGGS, the Chairman and Managing-Director of Messrs. Henry Briggs, Son, and Co., Limited. He went to Leeds from his residence at Windermere last Thursday, to attend a meeting of the Company on Friday, on the morning of which day he was found in his room seriously ill. He died from heart failure within a few minutes of being discovered. Deceased was a member of the Board of the Leeds Fire-Clay Company, and quite recently presided at a meeting of shareholders. He was Lord Mayor of Leeds in 1903; and towards the end of his term of office was elected an alderman. He was Deputy-Chairman of the Watch Committee of the Corporation, as well as Chairman of the General Purposes Sub-Committee. It was at his suggestion that the Water Committee (of which he was a member) should adopt a scheme for the afforestation of the Washburn Valley as a means of finding work for the unemployed. He was a Justice of the Peace for the city of Leeds as well as for the West Riding of Yorkshire. Deceased was in the prime of life, being only 51; and his loss is regarded in Leeds not only as a personal bereavement but as a public misfortune. He leaves a widow, one daughter, and two sons. The funeral was fixed for to-day.

In the report on the work of the Reichsanstalt in the past year, it is stated that the Optical and Photometrical Department showed that the best performance of an electric arc lamp was 0·76 watt per Hefner candle mean spherical intensity, and of an incandescent gas-lamp 1·2 litres (0·042 cubic foot) of gas per candle.

The King has been pleased to appoint a Royal Commission "to inquire into the existing system of management of the lights, buoys, and beacons on the coast of the United Kingdom by the three general lighthouse authorities, and as to the constitution and working of these authorities, and to report what changes, if any, are desirable in the present arrangements." The members of the Commission are the Right Hon. G. W. Balfour (Chairman), Sir Frank Forbes Adam, C.I.E., Colonel I. J. C. Herbert, C.B., C.M.G., M.P., Vice-Admiral W. H. Henderson, Mr. M. A. Ennis, and Captain C. Bigham, C.M.G. (Secretary).

ANALYSES OF AMMONIACAL LIQUORS FROM GAS-WORKS.

Our readers are aware that special features of the annual reports of the Chief Inspector under the Alkali Acts (Mr. R. Forbes Carpenter) of late years have been the tabulated results of analyses of ammoniacal liquor carried out by his Assistant (Mr. S. E. Linder, B.Sc.). The recently issued report contains a memorandum on the subject, in which Mr. Linder deals with the liquors from gas, coke-oven, shale, and iron works; and in an appendix gives an analysis of a typical gas liquor. Interesting as are the results presented, we can only reproduce the first of the series of large tables—that containing the analyses of liquors taken from the storage wells of gas-works—with the remarks bearing upon it. These we give below.

The results indicate generally that oxidation changes have proceeded very far. This is attributed in great measure to the fact that storage wells at gas-works are large. Gas liquors are generally stored for many days—occasionally for many weeks—before distillation. In addition, the small amount of oxygen entering the condensing and scrubbing plant with the crude coal gas will be a factor operating in the same direction. The effect of storage upon the composition of gas liquors is well illustrated by a comparison of the two samples (*a*) and (*b*) from No. 1 works. The same quality of coal was in use, and the same method of distillation employed, during the two periods when the samples were obtained. At these works liquor is distilled from October to March, and stored from April to September. The January sample (*a*) was therefore comparatively fresh; the July sample (*b*), on the other hand, represented an average of several months, as the sulphate plant had not worked since March. Consequently, oxidation changes were at a maximum in the summer sample (*b*), and at a minimum in the winter (*a*); sulphide at a minimum in (*b*), and at a maximum in (*a*). Thus:

	Percentage of Total Sulphur.		
	Sulphate, Thiocyanate, and Thiosulphate.		Sulphide.
Winter sample (*a*)	27·2	..	72·8
Summer sample (*b*)	78·8	..	21·2

The total ammonias approximate in the two samples; but the "fixed" ammonia in (*b*) is nearly double that in (*a*). While these striking differences in composition are considered to be mainly due to the conditions under which the liquor was stored, the fact should not be overlooked that the scrubber conditions must have been widely different when the two liquors were made, seeing that 900,000 cubic feet of coal gas passed the condensers and scrubbers per 24 hours in January, while in July the same condensers and scrubbers dealt with only 250,000 cubic feet. The extent to which this factor operated in determining the quality of gas liquor made cannot, however, be determined, as the samples were in both cases taken from the storage wells. In No. 5 (*a*), liquor passes at once to the concentrating plant. Here we see that "fixed" ammonia is low, and sulphide and cyanide (HCy) are both high.

We may take an opportunity, in some future issue of the "JOURNAL," of noticing the other tabulated results.

ANALYSES OF GAS-WORKS LIQUOR FROM STORAGE WELLS.

Liquor.	Deg. Tw.	Ferrocyanide as HCy. Gramme per 100 c.c.	Chloride as HCl. Grammes per 100 c.c.	Distribution of Sulphur. Per Cent. of Total Sulphur. As Sulphate.	As Thiocyanate.	As Thiosulphate and Sulphite (by Diff.).	As Sulphide.	Total Sulphur. Gramme per 100 c.c.	Per Cent. Sulphur to Ammonia.	Ammonia. Total. Grammes per 100 c.c.	Fixed. Grammes per 100 c.c.	Free. Grammes per 100 c.c.	Free. A. H E.	Carbonic Acid. Grammes per 100 c.c.	Carbonic Acid. B. H.E.	Sulphuretted Hydrogen. Grammes per 100 c.c.	Sulphuretted Hydrogen. C. H.E.	Hydrocyanic Acid. Gramme per 100 c.c.	Hydrocyanic Acid. D. H.E.	Total Acids. (B + C + D$_1$) H.E.	Difference of Acids. (B + C + D − A.) H.E.	Difference of Acids. (B + C + D − A) NH_3,HE = 100.	Saturator Gases per 100 Vols. (by Theory). CO_2.	H_2S.	HCy.
No. 1 (*a*), 24/1/05 . . .	6·3	0·0068	0·776	0·7	23·4	3·1	72·8	0·8547	31·1	2·752	0·576	2·176	128·0	2·551	116·0	0·661	38·9	0·068	2·5	157·4	+ 29·4	+ 23·0	72·5	24·3	3·2
No. 1 (*b*), 6/7/05 . . .	5·6	*Nil*	1·270	4·5	57·9	16·4	21·2	0·9120	30·6	2·980	1·060	1·920	112·9	2·122	96·5	0·205	12·1	*Nil*	..	108·6	− 4·3	− 3·3	88·9	11·1	*Nil*
No. 2, 6/2/05	5·5	0·0576	0·326	26·9	22·4	12·2	38·5	0·6552	34·2	1·915	0·447	1·468	86·4	2·057	93·5	0·268	15·8	0·003	0·1	109·4	+ 23·0	+ 26·6	85·4	14·4	0·2
No. 3 (*a*), 8/7/05 . . .	6·9	0·0460	0·944	1·5	14·6	11·8	72·1	0·8350	24·7	3·381	0·639	2·742	161·3	3·240	147·3	0·640	37·6	0·005	0·2	185·1	+ 23·8	+ 14·8	79·5	20·3	0·2
No. 3 (*b*), 8/7/05 . . .	2·3	*Nil**	1·352	3·3	55·9	40·8	*Nil*	0·3630	40·7	0·891	0·845	0·046	2·7	..	..	*Nil*	..	*Nil*	..	..	..	..	..	..	..
No. 4, 14/3/06	3·6	*Nil*	0·511	1·7	22·7	4·5	71·1	0·5044	30·0	1·681	0·345	1·336	78·6	1·476	67·1	0·381	22·4	0·0355	1·3	90·8	+ 12·2	+ 15·5	72·9	24·3	2·8
No. 5 (*a*), 18/2/06 . . .	..	0·0153	..	..	..	..	..	..	..	2·129	0·206	1·923	113·1	2·200	100·0	0·905	53·2	0·0623	2·3	155·5	+ 42·4	+ 37·5	63·4	33·7	2·9
No. 5 (*b*), 20/2/06 . . .	..	0·1720	..	..	..	..	..	..	..	17·765	0·425	17·340	1020·0	18·260	830·0	6·830	404·7	0·0054	0·2	1234·9	+214 9	+ 21·1	67·2	32 6	0·2
Average . . .	5·6	0·021	0·765	6·5	29·6	10·0	53·9	0·7522	30·4	2 473	0·545	1·928	113·4	2·274	103·4	0·510	30·0	0·0290	1·1	134·5	+ 21·1	+ 18·6	76·3	22·1	1·6

Alkalinity to MeO calculated as NH_3 = 0·034

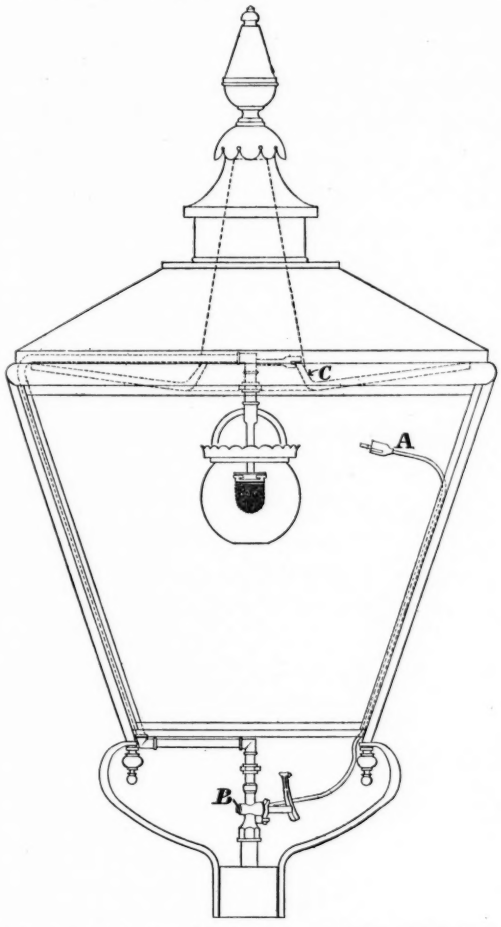
[No. 1 (*a*).—900,000 cubic feet of gas scrubbed daily. No. 1 (*b*).—250,000 cubic feet scrubbed daily. No. 3 (*a*).—Feed to boiler. No. 3 (*b*).—Effluent from boiler. No. 5 (*a*).—Liquor from well. (No. 5 (*b*).—Concentrated liquor.]

Remarks.—No. 1 (*a*) (*b*).—Gas liquor stored from April to September, distilled from October to March. Inclined retorts are in use for gas making. No. 2.—Storage for six weeks' make of liquor. No. 3.—(*a*) Storage for about two months' make of liquor. (*b*)* Soluble ferrocyanide all converted into insoluble ferrous ferrocyanide on boiling. No. 4.—Storage for nine days' full working of sulphate of ammonia plant; liquor brought in barge from other stations. No. 5.—Liquor (*a*) distilled, as made, to concentrated liquor (*b*). Average.—Nos. 3 (*b*) and 5 (*b*) are excluded.

A writer on "The Vertical Gas-Retort" in "Engineering" says: "The experience so far gained with vertical retorts appears to show that they are not merely practicable to build and work, but that they promise many advantages over the horizontal or inclined types. Their use certainly involves elevating machinery and overhead conveyors and hoppers for the coal; but this is also necessary for inclined settings. The costly charging and discharging machinery required for working large benches of horizontals is entirely done away with, and the space required on each side of the benches for these great machines to travel up and down the house need no longer be allowed. The present long ascension-pipes connecting each retort with the hydraulic main will be replaced by very short ones; and the nuisance of 'stopped pipes' either eliminated from the worries of the retort-house or reduced to very slight dimensions. Whether vertical settings will in time become general, it is impossible to say; but many gas engineers look to the system as a distinct advance on the way to more efficient practice."

THE LANTERN FOR THE INVERTED GAS-BURNER LIGHTING IN EDINBURGH.

In the "JOURNAL" last week, announcement was made of the success of the "Star" inverted burner in winning the favour of the Edinburgh authorities for adoption in their novel scheme for the lighting of the city. We have since received a drawing from Messrs. R. Laidlaw and Son, Limited, of Edinburgh, showing the lantern which they have specially designed and are making for giving effect to the scheme. The construction of the lantern and the method of suspending the burner are plainly depicted. It may, however, be mentioned that the framework of the lantern is of copper; and the reflector and rising cone are of enamelled



The Lantern for the Inverted Gas-Burner Lighting of Edinburgh.
A. Flash-Light. B. Special Cock, with Bye-Pass to Flash,
C. Earthenware Reflector.

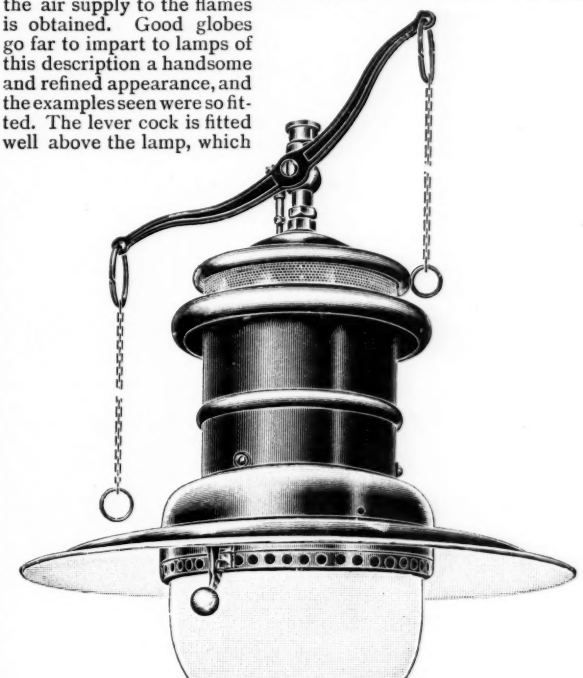
earthenware. The question of lighting these inverted lamps is of great importance; and it will be remarked that a special form of cock, with a bye-pass to the flash-light, has been provided. The lamplighter's torch on being introduced into the lantern gives the cock a half turn and lights the flash-jet, which shoots over and ignites the gas issuing from the burner. The withdrawal of the torch shuts off the supply of gas to the flash-jet arrangement, and turns on a full supply to the burner. It is a large order that Messrs. Laidlaw and Son have secured; and they are to be congratulated on being identified with this unique lighting scheme.

The Supply of Air Gas in France.—According to an article in the current number of "Le Gaz," plant for the production and supply of air gas is in use at Cosnes-sur-l'Œil (Allier) and Cirey-sur-Vezouze (Meurthe-et-Moselle). At Charly (Aisne), air gas is being inhabitants; and arrangements are in progress for the supply of Brétigny (Seine-et-Oise), Pierrefonds (Oise), and Vatan (Indre) by the coming winter.

Estimation of Ammonia in Water by Nessler's Reaction.—In a recent number of the "Comptes Rendus," this subject is dealt with by M. Albert Buisson. The author investigates Nessler's reaction, and finds that it is not total, but that a state of equilibrium is established between the different elements present. The estimation of ammonia in water, effected by the estimation of the mercury in the precipitate, is inexact; the total ammonia not being precipitated, and the composition of the precipitate not being estimable by any known law.

"SILVA" INVERTED CLUSTER LAMP.

Here we have an exceedingly smart looking inverted cluster lamp made in two forms—the one illustrated being that encased for outdoor use. The lamp is the newest addition to the great variety of gas-lighting appliances that Messrs. J. & W. B. Smith, of Farringdon Road, have put on to the market. There is no necessity to say anything more about the outdoor type of the lamp than that its casing is double enamelled in a manner which gives to it a really good appearance, and it is wind and rain proof. The specimen lamp examined was of the indoor type; and the description of its construction will suffice (with the foregoing explanation) for that of the outdoor type. In this lamp, use has been made of the firm's "Veribest" inverted burners (with special air-regulating shutters), three of which are clustered round the central supply tube. They are connected to the tube by three short arms, and being very compactly situated give a larger choice of globes to the user. The three bunsen tubes of the burners pass down through a white enamelled iron heat disperser, arranged so as to deflect the heat sideways and keep the hot products of combustion well away from the primary air supply to the burners. Between this disperser and the large reflector, there is such an excellent amount of space that the globe keeps comparatively cool, and so is not subject to the destruction that threatens globes, through over-heating, where meagre consideration is given to ventilation. The globe is supported by a hinged ring, with a weighted catch fastener; and through numerous perforations in the brass ring the air supply to the flames is obtained. Good globes go far to impart to lamps of this description a handsome and refined appearance, and the examples seen were so fitted. The lever cock is fitted well above the lamp, which



The Outdoor Form of the "Silva" Lamp.

ensures it always being kept cool; and from it runs a very effective flash-light bye-pass, serving all three burners. The consumption of gas is 11 cubic feet an hour; and the illuminating power is approximately 250 candles. While an excellent downward light is obtained, there is also such a useful distribution of illumination, that for shops and other interiors suitable for such a lamp, it will be found an economical means of illumination.

THE "VESTA" REGENERATIVE INVERTED BURNER LAMP.

It is remarkable to notice how to all the new high-power, ordinary pressure lamps that are being introduced for the coming lighting season, the inverted burner is being applied. This is not the result of any whim or a pandering to a temporary fashion; but the richness of the downward and horizontal light of the inverted burner gives such a large scope of usefulness that a demand has arisen and is extending for this class of lamp. The "Vesta" lamp of Messrs. Falk, Stadelmann, and Co., Limited, of Farringdon Road, London, and Great Clyde Street, Glasgow, is one of those in which the inverted burner has been adopted; and the inverted burner truly allows a very neat style of lamp-construction. But in this particular form, there are some distinctive

features, which admit of the use of the word "regenerative" in its description. Each burner is furnished with a separate inner glass chimney, which, apart from protecting the mantle, promotes more perfect combustion, and intensifies the incandescence of the mantle. Above these glasses are metallic tubes which increase the rapidity of the independent warm air

Three-Light Inverted Burner "Vesta" Lamp.

currents set up, and cause the dispersion of the heated products of combustion. A secondary advantage arising from this is that vitiation of the primary air supply is avoided. A further improvement is found in the regulating gas nipples which can be adjusted from the exterior of the casing to suit local conditions in regard to pressure and illuminating power. The tested efficiency of the lamp is 31 candles per cubic foot of gas consumed; each burner consuming 4 cubic feet per hour, and the reflected light being 125 candles per burner. The lamps are made with one, two, three, or four burners; and from the figures just given, their respective illuminating powers can be readily calculated. It is a lamp built upon scientific principles, and promises by performance to give the highest satisfaction to users.

THE "MIDNIGHT SUN" GAS-BURNER.

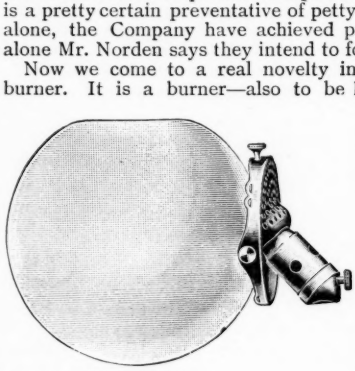
The "Midnight Sun" is the figurative title given to an incandescent gas-burner which has just been brought under notice by the Midnight Sun Incandescent Company, of 11, Queen Street, Worthing. Whatever justification there is for the title is found in the high illuminating power obtained. While we say this, it would have given us greater pleasure if the burner had not come to us with a reputation which we cannot accept, and which is disproved by trial. It is said that the lamp "gives as much light as ten ordinary incandescent burners, 31 times as much light as an ordinary gas-burner or a 16-candle electric light, and only costs a farthing per hour." In a circular, the illuminating power is stated at 500 candles. At the pressure at which we have had the burner in use, when giving its maximum illuminating power it was consuming approximately 9 cubic feet of gas per hour; which is equal to about a farthing's worth of gas per hour at 2s. 6d. per 1000 cubic feet. But 9 cubic feet and an illuminating power of 500 candles would mean that the efficiency of the burner is equal to over 55 candles per cubic foot of gas consumed at ordinary pressures. The absurdity of this may not be apparent to the public, but it is to any gas technician. The illuminating power of the burner is not anything like the figure named. But it is good for a light from a single source. It is not, however, our business to say precisely what the illuminating power is; but it is due entirely to the construction of the burner—amplitude everywhere being the dominating feature. The burner is about 5½ inches long, with a large chamber at the bottom, into which the gas passes from the nipple and into which the air is drawn in the necessary regulated quantity. But the bunsen tube connecting with the head of the burner is of relatively small diameter; and this discharges again into a large head of about 2 inches deep. The chimney, too, is spacious, 10 inches long, and is perforated for lateral air supply; the bottom of the chimney gallery being completely closed. The mantle itself is 5½ inches long; and despite its length, it is well filled with flame, and gives an excellent incandescent surface.

AN INCANDESCENT MANTLE COMBINATION.

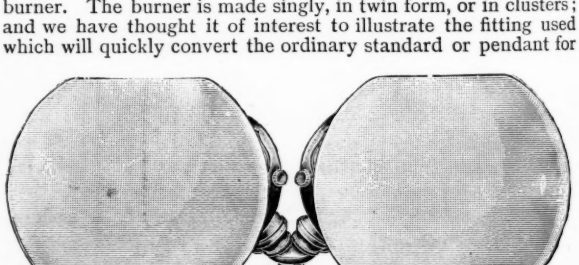
And a Novel Inverted Gas-Lamp.

From the firm which has hitherto been known as the United Chemical Works (Norden and Co.) has been developed a large concern under the title of the United Chemical Works, Limited. It is an amalgamation of no less than seven firms in England, Germany, and Italy; and thus it will be seen that its operations will be wide and far-reaching. Mr. Julius Norden will still direct the business in London. The object of the amalgamation is not the enrichment of the amalgamated firms at the expense of the consumer; but by the anticipated great development in business, and the greater capacity for purchase and dealings generally, to produce mutual advantage for Company and consumers. In the new concern, there are at least 1000 hands employed; and the output of mantles at the present time, we are informed, is 30 millions per annum, and this is said to be an under-estimate. The productive capacity greatly exceeds this, so that the Company are well prepared for any augmentation of business that may arise from the combined efforts of their various branches. In London the business in the "Ino" mantles—particularly with gas companies and local authorities—has grown so enormously, that the Company, it is found by inspection, have had to greatly extend their office and storage accommodation. Speaking of the "Ino" mantles (which as readers are aware are made in all sizes and qualities and for all purposes), the Company have introduced the system of—if desired by purchasers of quantities—stamping the mantles with names, initials, or a distinguishing number for controlling purposes. This must be very useful where the maintenance of private and public lights is in vogue; and it is a pretty certain preventative of petty depredations. On merit alone, the Company have achieved present success; on merit alone Mr. Norden says they intend to forward that success.

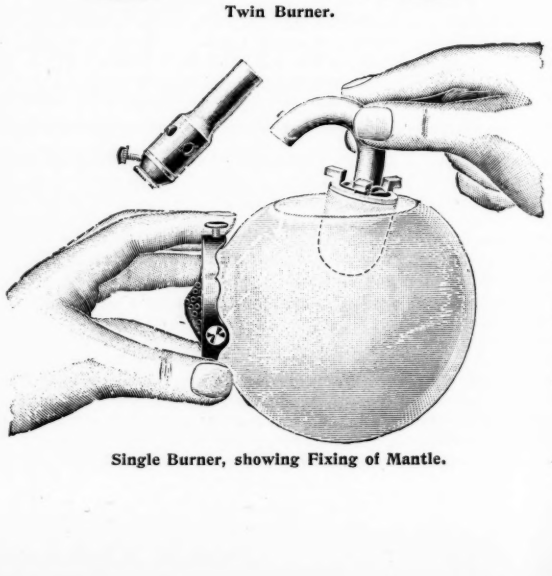
Now we come to a real novelty in the way of an inverted burner. It is a burner—also to be known as the "Ino"—in which the consumption of gas is low, but no extravagant claims are made for it in respect of illuminating power. With the complete fitting as supplied, the light is good and beautifully soft for work—the eyes being completely shielded from any glare. But the novelty is that the burners are adaptable to ordinary fittings without any auxiliary connecting piece. This and other conveniences are realized by the angle of the bunsen tube, and the method of constructing the burner. The burner is made singly, in twin form, or in clusters; and we have thought it of interest to illustrate the fitting used which will quickly convert the ordinary standard or pendant for



Single Burner.



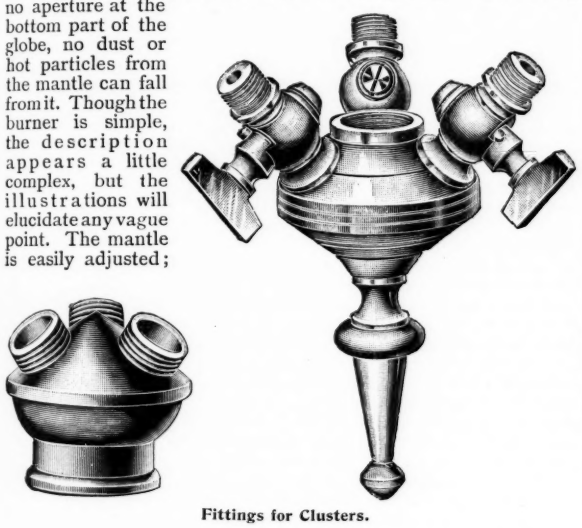
Twin Burner.



Single Burner, showing Fixing of Mantle.

cluster lighting. Several very effective combinations can be made with this burner; or by merely removing the upper part of an ordinary "C" burner, and the lower part of the new burner, the inner bunsen tube of the latter can be slipped on to the bunsen tube of the "C" burner, and the conversion from vertical to inverted form, or *vice versâ*, is thus promptly accomplished.

The burner itself is made in four separate parts. There is the solid portion at the bottom, with the connecting opening and thread made at an angle in the side, and with the gas nipple above. A thumb-screw is provided for regulating the gas supply; the screw opening and closing a cross-cut pin in the gas-way. Screwing on to this piece is the inner portion of the bunsen tube with widened end, in which are the air-inlets, also with their regulating shutter. On to this slides the outer bunsen tube (all at an angle), which carries the globe holder, the upper portion of which has a perforated back, while the lower part is quite open. The inner and outer bunsen tubes are also held firmly in place by a thumb-screw. Into the top of this slides the curved burner head, with its nozzle and mantle support. The burner head is maintained in its position by a projecting piece sliding into a slot in the outer bunsen tube. The globe itself is unique. It has only a top and side opening; the latter being the one by which the globe is carried in the gallery. There being no aperture at the bottom part of the globe, no dust or hot particles from the mantle can fall from it. Though the burner is simple, the description appears a little complex, but the illustrations will elucidate any vague point. The mantle is easily adjusted;



Fittings for Clusters.

and another feature is that there are no visible metallic parts that are exposed to the flame. Neatness is also a characteristic. With opal globes, the appearance is a large ball of soft light; and its effect is good. We fancy this burner will claim the immediate interest of the gas profession.

Gas Progress at Trieste.—The annual accounts for the year ending Dec. 31 last, relating to the municipal gas and electricity undertakings of the City of Trieste have been published; and they show continued progress and prosperity. The make of gas was 14,795,300 cubic metres (about 522,519,000 cubic feet), compared with the previous year's production of 13,226,600 cubic metres, or about 467,119,000 cubic feet. There is thus an increased production for 55,400,000 cubic feet of gas for the year. "These figures," says the annual report, "show better than any comment the necessity of immediate foresight in increasing the producing plant." We gave in the "JOURNAL" for the 10th of April last an illustrated description of the Trieste water-gas plant, and are pleased to see the great progress that is being made at the works under the management of Sig. Sospizio.

Affording a Temporary Supply while Relaying Gas-Mains.—To the "Wrinkle Department" of the Western (U.S.A.) Gas Association, of which Mr. Bryce M'Adam is the Editor, several gas managers on this side the Atlantic send contributions. One on the above subject was furnished by Mr. F. C. Humphrys, of Ilkeston, as follows: "When a main has to be relaid, it is now necessary, owing to the number of gas engines, cookers, &c., that there should be no cessation of supply. The plan I have adopted with great success recently is to tap a large hole in the live main, connect a piece of flexible metallic hose, form a rider of wrought-iron pipe, and connect on to a main; leaving a sufficient section bye-passed for the operations of the day. A couple of gas-bags make this section dead, and operations are commenced on the section, services transferred, a temporary connection made with the old main, and gas supply resumed for the night. The last pipe has drilled in it two holes, one of which may be reduced, and used as a stand-pipe for the night. All is ready for the rider next morning. Should any consumers on the dead section want a supply, an india-rubber pipe connection will suffice. Also, should it be impossible, owing to bad weather or other causes, to complete the connection between the old and the new main, the rider will ensure the district from being entirely without gas."

GROWTH OF PUMPING-STATIONS IN AMERICA.

At the last meeting of the American Water-Works Association, a paper on this subject was read by Mr. CHARLES A. HAGUE, from which we make the following extracts.

The capacities of pumping-engines and the dimensions of buildings to contain them have been on the general increase in America ever since 1878—a period from which dates the beginning of the wonderful development and rapid building of plant after plant for public supply, to say nothing of enlargement and improvement of plants already existing in cities large and small. Thirty years ago, pumping-engines of from 2 to 5 million gallons daily capacity were considered of some importance; and so they were, to the communities buying and using them. Occasionally a machine of greater capacity than these came into existence, going perhaps, as in the case of Chicago and other large Western cities, as high as 10 million gallons. But nowadays the 10-million gallon machine is left far behind in the march of improvement, and in the tremendous development of the country, until it has come about that a bulk of 12 million gallons is considered to be moderate and reasonable, 15 million gallons common, 20 millions not unusual, and 25, 30, and even 40 millions not surprising.

In water-works pumping it seems to be a question of unit in proportion to the gross demands; and it will pay anyone responsible for the quantity, cost, and quality of water for public supply to carefully consider the relations between the above-mentioned items. A good rough rule in a growing plant, occasionally enlarged, is to instal each new engine of a capacity equal to the sum of the capacities of the engines already in place, until the new engine reaches the limit of the size of unit appropriate for the plant in question. For example, if a plant has been started with two 5 million gallon engines, when a new one goes in make it a 10-million; or if started with a 5-million, and afterwards supplemented with a 10-million, put in a 15-million engine.

In the growth and development of the pumping-station, refinement in machinery, and reduction in cost of manufacture, through better and more appropriate designing, coupled with more efficient and economical shop management, led to higher duties in steam economy; and this gradually changed designs, and consequently the sizes and forms of buildings. The old fight between low first cost and low duty, and high first cost and high duty, in time quieted down by the great advocate of low duty and low interest accounts, finally being forced to enter the field of a higher economy or retire to the background. The higher steam pressures which go hand in hand with greater steam economy, changed the ideas on boilers, brought greater horse power per boiler by enlarging the units and gross demands, and led to restricting the dimensions of the boiler plant so far as practicable. Probably for good every-day efficiency, the horizontal return tubular boiler is as good as any and better than most. But where large powers are involved, the room required and the size of the necessary buildings place a limit upon the consistent size of boilers and units of this type. The writer is firmly of opinion that, under present circumstances of unit capacity, gross demands, economy of construction, and convenience and economy of operation, together with considerations as to buildings and space required, the water-tube boiler, fitted with automatic stokers, takes the lead as a general steam generator for water-works pumping-plants. But this should be supplemented with the statement that the limits of steam economy in the pumping-engine are about reached both theoretically and practically. In the year 1893, the duty record was 154 million foot-pounds per 1000 lbs. of steam; while now it is only 181 millions.

The relation between the difference in economical duties of pumping-engines and the amount of boiler horse power required per pump horse power for various duties of engines, may be conveniently illustrated by the accompanying table, in which 10 square feet of heating surface is reckoned per boiler horse power.

Duty in Foot-Pounds per 1000 lbs. of Steam. Millions of Gallons.	Boiler Horse Power per Pump Horse Power.	Duty in Foot-Pounds per 1000 lbs. of Steam. Millions of Gallons.	Boiler Horse Power per Pump Horse Power.
40	1·63	140	0·47
50	1·32	145	0·46
60	1·10	150	0·44
70	0·94	155	0·43
80	0·83	160	0·41
90	0·74	165	0·40
100	0·66	170	0·39
110	0·60	175	0·38
115	0·57	180	0·37
120	0·55	185	0·36
125	0·52	190	0·35
130	0·51	195	0·34
135	0·49	200	0·33

In considering the growth of the water-works pumping-station, the earlier practice was not free to plan extensively for the future, though it can be seen now that very much better work on this line could have been done than was actually accomplished. The main point is to look ahead, and calculate as nearly and as clearly as may be the growth of the city and its probable demands in the future. Of course, it cannot be expected that actual and accurate prophecy need be indulged in. The principal thing is to think of the matter in some shape or other, and at least have an idea that enlargements are bound to come, and increase in capacity is

inevitable in future. Thirty years ago, no one foresaw sufficiently to grasp the idea of the rapid strides in development about to come to America, and therefore could not naturally have conceived the ideas which now seem so natural. It would not have been necessary to provide extensive and costly buildings, intakes, screens, wells, &c., all at once, and then wait for the demands of the community to grow up to the situation, but rather to arrange and design a plant of comparatively moderate dimensions in proportion to the existing demands, so that it might be enlarged afterwards, unit by unit; and it would have been possible and practicable to introduce enough elasticity into the scheme to meet the varying changes in ideas of improvement which it is now seen have taken place.

Make the most and the best of what you have, and plan more wisely for the future; and in doing so do not try to utilize too much of the old works about a pumping-station, with a mistaken idea of economy. It is often cheaper to put up something entirely new, and when finished connect it to the regular establishment by a short and quickly made change, than to endeavour to rebuild and enlarge already existing buildings and intake accommodations. Sometimes unattractive concessions have to be made to suit changes in old structures and appurtenances which would not be tolerated for a moment with a clear field in view. Do not be extravagant, but also do not be stingy in arranging for the growth of your pumping-station.

It is scarcely possible that the cost of pumping-stations for water-works will be increased on account of a higher type of engine, because it is pretty evident that the top limit has been just about reached with the new record of a little over 181,000,000 lbs. duty per 1000 lbs. of steam. If there were no necessity for the use of jacket steam, the figure would approach rather closely 200,000,000 foot-pounds duty; and if superheating can save the jacket steam and vitalize the working steam, the latter figure may in the near future be reached so far as the report on high duty accomplished in a calculation is concerned. But if this pleasing result is obtained by a surface condenser with a consequently smaller air-pump, although this type of condenser may require more maintenance than the jet form, and if the superheated steam is at the cost of coal, what is the use of it?

If the steam-turbine or the gas-engine can step forward at this stage of the growth of the pumping-station, and show something better in the matter of water sent up the hill in proportion to the coal bought and burned, it is now open to them to do so. This will, of course, effect a rather radical change in pumping-stations, at least so far as the buildings are concerned. Probably, however, the changes will be in the line of smaller engine-houses and larger boiler and coal houses. Unless something very much out of the line of view at present develops in the near future, the ideal turbine pumping-engine will be a turbine steam-engine driving a turbine pump, all mounted upon the same frame. No reciprocating steam-engine can live under the speed required for turbine pumps under the ordinary water head demanded by the average water-works. The larger triple-expansion engines, both direct-acting and crank engines, pump a million gallons of water per day with $625 worth of coal per annum for the best records, and $900 is an ordinarily good record; while about $1350 is the steam turbine pumping record, so far as the writer can learn.

The gas-engine as a water-works motor is, of course, entirely undeveloped upon anything like the scale which it will have to reach to be seriously considered in fairly large schemes of water-works pumping. There will be found to be a great variation in the gas production from different kinds of coal—probably as much as in the generation of steam from different fuels—not only from the difference in the coal itself, but also from variations in the gas-making apparatus. But development on this line is going on, and good results in economical and reliable gas production, easy of manipulation, will no doubt be one of the improvements of the near future. The large gas-engines available for pumping for water-works have not as yet come prominently to the front, and there are certain adaptabilities necessary to be made touching the matter of speed, for example, which complicate the problem. There are many small pumping-plants where the gas-engine fits in very well; but there are some incidental items apart from actual fuel economy which have great weight proportionately in a small pumping-plant, but which would not be considered in a large one. The gas-engine at its best can probably produce 1-horse power with 1 lb. of coal; but this imposes conditions not favourable to the economical pumping of water under pressure suitable for water-works stations. The record of 1·02 lbs. of coal per indicated horse-power-hour is held in Boston by a pumping-engine specially adapted to the pumping of water upon a large scale. Consequently, the modern steam pumping-station has already reached the apparent goal of possibilities in low coal consumption—quite as low as the gas-engine can accomplish in actual service; the steam station running generally from 1 lb. per indicated horse power on tests, to a range in actual every-day service from 1·33 lbs. to 1·98 lbs. of coal consumed per indicated horse-power-hour.

But the mere statement of the relation between various rates of efficiency in coal per power unit does not tell so much as a slight analysis of the factors. For example, confining for the moment the comparison to steam pumping-engines, the writer has two records, one of 1·02 lbs. and the other of 1·98 lbs. of coal per indicated horse-power-hour; both records being obtained as nearly as could be under similar conditions in actual water-works pumping. The latter fuel is slack at $1·50 per ton, and the former is anthracite at $4·50 per ton. The analysis of the coals for heat units on complete combustion was, in round numbers, as follows: Slack, 11,000 per lb.; anthracite, 14,000 per lb. In the case of the slack, the buyer obtained 146,000 heat units for 1 c.; and in the case of the anthracite coal, the buyer obtained 62,000 for the same amount. The plant using the slack consumed 363 heat units per horse power per minute, while that using the anthracite coal consumed 238 units. The efficiency of the boilers was 70 per cent. in the case of the slack, and 80 per cent. in the other case. This reduced to work demonstrated by indicated horse power gives 13,200,000 foot-pounds for 1 c. in the case of the coal, and 9,805,680 pounds for 1 c. in the case of the slack, with the efficiencies of the boilers equalized. This, of course, shows that a difference of 3,394,320 pounds for 1 c. existed in the different economy of the two engines. A comparison between the duties per 1000 lbs. of steam and the foot-pounds for 1 c. obtained in the two cases shows one to be a little above and the other a little below 30 per cent. gain, which is near enough for a check.

A comparison between the two methods—one with steam and one with gas—shows that the steam pumping-plant and the gas-engine with gas-producer are just about on an equal footing so far as producing an indicated horse power in proportion to the consumption of coal per hour is concerned. This, of course, brings the matter between the steam-power plant and the gas-power plant down to the question of investment of money in the plant itself, together with the current cost of operation and maintenance. The gas-power plant has not yet made sufficient records to enable us to determine very much in the pumping line upon a considerable scale; but, whatever it will do in the future, it is perfectly evident at present that the steam pumping-station has just about reached its economical limits in the best plants, though as yet only a small percentage of the plants in existence are enjoying the fruits of the advanced practice. The present high type of pumping-engine cannot apparently be improved to any material extent; so that the very best we can expect is an extremely small increase in economy by means of improved construction. An increase in coal economy from 6 per cent. to 12 per cent. can most likely be gained by the use of superheated steam, though the interested and intelligent advocates of superheating will probably say this is too low a figure for the gain. But it must not be forgotten that many of the good records for superheating have been made where engines of only fairly good economy are in use; whereas when the highest type of pumping-engines are supplied with superheated steam, the application is made to steam machinery of the very best class, where multi-expansion, steam-jackets, reheating, &c., are used to reduce the internal losses and condensation to an extremely low point.

The quadruple-expansion pumping-engine with an additional steam cylinder, resulting either in a tandem arrangement for a portion of the engine or an abandonment of the very desirable three-plunger scheme, so favourable for steady hydraulic effects, has no great future before it; and even if it had, there is no good reason for making material changes in the station building, for it will, of course, be a vertical machine when the present-day units are considered, and will possibly occupy no more floor space. But it may never come at all to any great extent, for, with the 33 to 40 expansions practicable with the triple machinery possessing such admirable mechanical lines, and with the conversion of heat into work about up to the limit, there is no room for the quadruple-expansion machine.

By looking backward over the road travelled during the last twenty years of growth of the pumping-station in America, it will be readily perceived that the demand has always been for a higher class of engine; and as the reduction of the fuel expense gradually became more of an object and more clearly possible, and there was a better understanding of the whole subject, the engineers and the men who pay the bills were brought closer together, until to-day it is surprising to see what a high-type of machine has been produced for a price which in the past would have been considered simply ruinous to the builder. In 1878, the Worthington pumping-engine fairly held the front line in the form of a direct-acting non-rotative compound condensing machine; and in many cases successfully disputed the field with the many forms of the crank and fly-wheel engines coming to the front. For a good many years the direct-acting engine held sway, and for durability and reliability as a machine for pumping water for public supply has never been excelled. But gradually the financial end of the crank and fly-wheel manufacturing establishment and the engineering end drew closer and closer together. Then the Worthington engine took on a high duty attachment, and the competition went merrily on. The problem was to reduce the capital account by simplifying the design and raising the duty—in other words, to maximize the efficiency, minimize the cost, and maintain the durability at the high level of the Worthington mark. The two former have been accomplished; but when we see one of the old-time direct-acting pumping-engines plodding along after more than a quarter-of-a-century of hard work apparently in good condition, we are not quite ready for a vote on the last of the three counts given above.

The drift of the pumping-station seems to be towards larger units and the vertical triple-expansion engine—not only large engines, but small ones; and we begin to be accustomed to seeing 6 million and even down to 5 million gallon triple vertical engines in operation. What the next ten years will bring out in the further growth of the pumping-station cannot be definitely stated. It looks extremely doubtful for the dominance of the

turbine type in that time, if at all; and the gas-engine has not yet really made a good start for the front line. Superheated steam and generally higher steam pressures up to about 175 lbs. will probably take place gradually; and that will likely be the last line of attack of the reciprocating triple-expansion engine. It therefore appears fairly safe to plan away for another generation at least, and look out for the future units during the remodelling of old plants or the construction of new ones. The perfect plant, so far as present evidence goes, will involve the following items: Water-tube boilers; mechanical stokers; natural draught at least 0·8 of an inch of water; feed-water economizers; damper regulators; coal bought on the basis of 14,000 heat units per pound; 175 lbs. steam pressure per gauge; moderately superheated steam by independent apparatus; modified steam jacketing and re-heating; smoke flue re-heating; vertical triple-expansion pumping-engines of long stroke; 200 feet per minute piston travel maximum; 20 revolutions per minute maximum; coal per indicated horse power hour, 1 lb. for large plants and 1·75 lbs. for small ones; and maintenance of engines, 1·5 per cent. for large and 3 per cent. for small plants. These and some other items of a similar nature, remarked the author in conclusion, are about what a look-ahead discerns as the coming events in the planning, construction, and operation of pumping-stations for public water supply.

The Removal of the Sulphur Restrictions.

The Act passed in the first session of the present year to remove the restrictions in respect of sulphur compounds now imposed upon certain gas companies was published last Friday by His Majesty's Printer of Acts of Parliament. Its importance is in inverse ratio to its length; for it consists only of a preamble, four clauses, and a schedule. The first clause gives the short title of the Act; the second relieves the companies named in the schedule of liability to forfeiture or penalty for the presence of sulphur compounds other than sulphuretted hydrogen in their gas; the third contains provisions for the protection of the Wandsworth Borough Council; and the fourth specifies that the costs of the Act are to be paid by the respective companies named in the schedule. These are as follows: British (Hull, Norwich, and Staffordshire Potteries), Cambridge, Harrow and Stanmore, Hastings and St. Leonards, Hampton Court, Ipswich, Newcastle-upon-Tyne and Gateshead, Reading, Richmond, Shrewsbury, Tunbridge Wells, Walker and Wallsend, Wandsworth and Putney, and Wolverhampton. The Act came into operation on the 20th of July.

Mr. Charles James Macintosh, a partner in the firm of Messrs. Walter H. Brown and Co., chemical brokers, of Leadenhall Street, E.C., whose death was announced in the "JOURNAL" for the 3rd of July, left £46,646.

Mr. James Hendry, at present serving under Mr. J. Ballantyne, in the Hamilton Corporation Gas-Works, has been appointed Manager of the Gas-Works at Midleton, Cork. It may probably be remembered that Mr. William Ewing, now of Greenock, was Manager at Midleton when he received the appointment at Hamilton, where he was for a number of years before he went to Greenock.

Mr. George Helps, of Nuneaton, we learn, has been retained by the Woolwich and Greenwich Unions, to inspect the books, and to give evidence in connection with the rating appeals, of the South Metropolitan Gas Company. Last year Mr. Helps was also retained in the matter of the Newport (Mon.) assessment appeal; and, as readers will have observed from the report which appeared a few weeks ago, he took part in investigating the affairs, and gave evidence for the Assessment Committee in the rating appeal, of the Ipswich Gas Company. If extensive experience of gas-works counts for anything in the work of the expert (some people mistakenly think it does not), then Mr. Helps has had that experience; for the works in which he has been engaged, during his career in the industry, include Bath, Hastings, Bahia (Brazil), Hinckley, and Nuneaton; and before going to take the engineership and management of the Hinckley works, he was employed for five-and-a-half years inspecting various works in Spain and Portugal, and obtaining concessions there for gas undertakings. It is not out of place, in mentioning this latest important evidence of the confidence of rating authorities in him, to call to mind the activity that Mr. Helps has displayed in various professional spheres. He is a Past-President of the Midland Association of Gas Managers; and, as is well known, a patentee of various gas-works apparatus and appliances, many of which are in use at such works as Birmingham, Leamington, &c. His new system of high-pressure gas distribution at Nuneaton—with 7 miles of mains, supplying gas at any pressure up to 25 lbs. per square inch—has attracted considerable notice and interest; and various works have been carried out by him in the capacity of Consulting Engineer. It may be added that Mr. Helps's energies have also been directed to contributions to the Technical Press; and, as the result of a special study undertaken by him of gas-works accounts, he has published a book entitled "Gas-Works Accounts and Management."

CORRESPONDENCE.

[We are not responsible for the opinions expressed by Correspondents.]

Low-Grade Gas.

SIR,—The criticism to which I have been subjected upon the above matter in your columns and elsewhere is aptly answered by Mr. Leicester Greville in your issue of the 21st inst. Mr. Greville is a gas-works chemist, physicist, and photometrist of no mean repute; and, referring to that part of my address pertaining to the above subject, he says he quite endorses my general views upon it.

Waterford, Aug. 29, 1906. R. BRUCE ANDERSON.

Tar for Road Purposes.

SIR,—I have been much interested in reading your article on the above subject in the current issue of the "JOURNAL;" also Mr. Maybury's evidence before the Royal Commission on Motor Cars.

That evidence should, I think, be treated with respect, as coming from one who has had experience in the use of various methods of applying tar to roads, and who at the same time would not lightly do an injury to the gas industry. I have no doubt he has good reasons for condemning raw coal tar for the purpose of dressing road surfaces; but I do not think his condemnation should be taken as the final word on the subject.

The object of the engineer responsible for the making and maintenance of the highways is, as I understand it, to find a medium for preventing the binding material of the road from working out as dust or mud. The binding materials in common use are marl, sand, &c., which in damp weather and with moderate traffic hold the road surface together very well. But under heavy traffic they work out as mud in winter and as dust in summer, with results now well known and appreciated. To substitute boiled tar and pitch as the grouting material when a road is being made up, and virtually form tar macadam *in situ*, would, no doubt, get over the difficulty at once; and it is to be hoped that this method of road making will eventually be adopted. Apart from the question of the abolition of dust, it may be found that, taking maintenance and scavenging into consideration, the cost will not exceed that of the imperfect methods now in use; but the greater first cost will probably prevent the rapid adoption of pitch grouting.

For the present, and for some time to come, therefore, a medium which will hold the binding material together, and prevent its working out as mud in winter and dust in summer, is urgently needed. In this connection, it may be as well to observe that the use of solutions of deliquescent salts for street watering has the objection that the absorption of moisture goes on in winter and renders the road sloppy.

In dealing with the question of tar for road surfaces, it is important to note that to make a permanent success it is not sufficient to form a thin skin of tar asphalte on the surface. This will, no doubt, do very well for a short time; but it is liable to peel off and to be lifted by frost. It is quite another thing to saturate the road material to a depth of some inches by a tar of great penetrating power which on evaporation leaves behind it pitchy matter. This is what takes place when oil tar is used, and to a lesser extent, no doubt, when raw coal tar is used; its efficiency for penetrating depending on the percentage of naphthas and light oils present. Experiments carried out on a large scale by the able and respected Engineer to the Norwich Corporation (Mr. Arthur E. Collins), with whom I have been studying this matter, go to prove that oil tar is an ideal medium; but I am hopeful that coal tar, possibly with the addition of a small quantity of naphtha or a light oil, may be made practically as efficient.

It will be interesting to know from those engineers who are also tar distillers, if experiments have been made with creosote (salty or liquid), and with what results. There is scope for a number of experiments, but I think the use of oil tar points the road to success; and it may therefore be as well if we keep the nature and action of this material before us in our efforts to find a new outlet for such an important bye-product as coal tar. The trials of the Lassailly pressure spraying machine will also be watched with interest, as by its use it is claimed that coal tar is made to penetrate a road surface to a depth of 2 inches. The tar in this case could not peel off.

I may add that, with oil tar at 1½d. per gallon, the cost per square yard of the first application, labour included, was 5-16ths of a penny.

Norwich, Sept. 1, 1906. THOS. GLOVER.

Sir George Livesey on the Rise in Coal Prices.

SIR,—I have only just seen the report of the remarks of Sir George Livesey at the meeting of the South Metropolitan Gas Company, to the effect that he anticipates a great rise in the values of gas coal in this country next year, and urges combination to resist what he calls an "outrageous advance." With your permission, I would venture to make two remarks thereupon: First, I am sure no one knows better than Sir George Livesey that, during the 34 years to which he calls attention—viz., since 1872—the great variations in the values of gas coals in this country have consisted of six or seven years in every decade of prices mostly unremunerative to the producers, and three or four years of more or less high prices, but producing, on the whole, an average, returning generally a less remuneration to the producers, in proportion to their risks and description of trade, than probably any other trade in the country. Secondly, I always thought that Sir George Livesey was a gentleman interested in the welfare of the labouring class. But here is a great industry (that of producing coals), of which the market value of the commodity which it produces consists to the extent of about two-thirds in labour wages; and he is asking his shareholders and the public to combine together to prevent one of those upward movements in value which occur, as I have said, so very

seldom, and by which alone even a tolerable average, alike of profit and of wages, is maintained over a series of years.

What I would venture to suggest to Sir George Livesey, as the only fair proposal, is that, after the advances which he anticipates during the next two or three years have rectified the average of the present decade, he should then propose that, for the future, there should be substituted for the heavy "ups and downs" of the last 34 years, reasonably remunerative average prices, with much slighter "ups and downs." If he will do that, I am sure he will receive the support of the colliery owners, and not least that of the owners of the collieries with which I am connected.

THOS. R. GAINSFORD.

Aug. 31, 1906.

The Proposed Illuminating Engineering Society for England.

SIR,—With reference to the remarks you kindly made last week concerning the proposed Illuminating Engineering Society for England, I should like to point out that the progress so far is encouraging, if due allowance is made for the fact that the vacation is, as a rule, not the most suitable time for successful propaganda. From the interviews I have had up to now with leading experts and representatives of the different lighting systems, I might say that almost all have agreed with me that the moment is ripe for something being done to put the lighting question on a more scientific basis, and that the benefits to be derived from an unbiassed investigation as to the true merits of the different illuminants are unquestionably great. If I met with any opposition at all, I am sorry to say it was mostly from the side of the gas people. The time has not yet arrived to proceed immediately with the formal inauguration of the Illuminating Engineering Society; and as the success of the Society will depend largely on the representative character of the members joining it, I shall be happy if readers of the "JOURNAL" will come forward and openly discuss the merits or faults of the suggested scheme, or otherwise join the Society in larger numbers.

LEON GASTER.

32, *Victoria Street, Westminster, S.W., Sept.* 1, 1906.

A Highly-Rated Gas Undertaking.—A correspondent writes: "I should be glad to learn through your columns if there exists in the United Kingdom any town so highly taxed by local rates as our own. They equal 5·68d. for every 1000 cubic feet of gas sold. Our population is about 4000, and the coals carbonized are a little below 1000 tons. If any of your readers suffer to a like extent, it would be some consolation to be aware of the fact." The town referred to is in Suffolk.

Woking Water and Gas Company.—At the ordinary meeting of this Company to-day, the Directors will report a balance at the credit of the profit and loss account of £3868 for the six months ending June 30, out of which they recommend the payment of a dividend at the rate of 4 per cent. per annum for the past half year, less income-tax. This will absorb £3196, and leave £672 to be carried forward. During the period covered by the report, 149 house and 26 meter connections were made, and the mains were extended about 3839 yards. The Engineers (Messrs. Joseph Quick and Son, MM.Inst.C.E.) report that the Company's engines, boilers, works, and mains are all in good order.

The Burst in the Liverpool Water-Main.—At the meeting of the Water Committee of the Liverpool Corporation last Tuesday, the Chairman (Alderman W. J. Burgess) referred to the unfortunate bursting of one of the Corporation's water pipes between Oswestry and Malpas. It had been stated in the report furnished to the Press that the pipe which burst was the 42-inch main; but, as a matter of fact, the one that failed was only 12 inches in diameter. Thus, although the burst was a serious matter, it was not nearly so bad as the public might have been led to suppose from what had appeared in many newspapers. Little or no damage had been done; and he was glad to say that the pipe had been sufficiently repaired to avert further danger.

New Water-Works for Rangoon.—An account was recently given in the "Bombay Gazette" of the Hlawga Water-Works, about 30 miles from Rangoon. These works comprise a series of reservoirs with nine dams of lengths varying from 200 yards to 2550 yards, aggregating 6100 yards in total length. The maximum height of dam is about 40 feet. The Hlawga reservoir, with the weir crest at 62 feet above datum, will, when the mains are fully developed, furnish some 40 gallons per head for 340,300 persons, or at 65 feet above datum the supply with suffice for a population of 410,000 at 40 gallons per head. The present 42-inch main will serve a population of 107,000 at 40 gallons per head. This is the most important reservoir constructed in Burma; and even with the surface level at 58 feet above datum it will contain a supply of nearly 230 million gallons. Nos. 2 and 3 dams are at present somewhat defective, in consequence of the employment of unsuitable materials, but repairs are being carried out.

Enteric Fever at Fleetwood.—A recent outbreak of enteric fever in the officers' mess of the 3rd Battalion of the Loyal North Lancashire Regiment at Fleetwood led to an investigation to ascertain the cause. Of course, the water was suspected; but as this was exactly the same as that supplied to the camp, as well as to Blackpool, Lytham, St. Anne's, and all the neighbouring places, and no sickness existed in the camp, while Fleetwood's bill of health was quite clean, the investigators were puzzled. It was eventually found that the water supplied to the officers came from pipes which had been laid by the War Office and the joints of which were found to be bad and leaky; and it was stored in a certain water-barrel cart which seems to have been in a dirty condition. The water had evidently been contaminated from one or both of these sources. Last Wednesday, Mr. Rankin, the Chairman of the Fleetwood Urban District Council, referred to the unnecessary attack made upon the water supply without awaiting for a full investigation of the outbreak. If the pipe leading from the main to the War Office land was affected, no blame attached to the Local Authority.

MISCELLANEOUS NEWS.

INSPECTION OF GAS LIQUOR AND OTHER WORKS UNDER THE ALKALI ACTS.

District Inspectors' Reports—Report to the Secretary for Scotland.

We conclude to-day our notice, commenced last week (p. 593), of the reports of the District Inspectors under the Alkali Acts, and give some particulars from the report of the Chief Inspector to the Secretary for Scotland.

Reporting upon the East Midland district, Mr. E. Morley Fletcher says that three sulphate of ammonia works were added last year to those under his supervision. One was a gas-works, and the others were coke-oven works where bye-products are recovered. The total quantity of ammoniacal products manufactured, given in terms of sulphate of ammonia, was 17,449 tons. The continuous process of distillation is used in the majority of the works. The plant employed in works for dealing with tar was maintained in satisfactory condition throughout the year, and no complaints arose.

In the South Midland district, over which Mr. E. Jackson watches, twelve new works were added to the register last year; seven being for the manufacture of sulphate of ammonia and three for the distillation of tar. On the other hand, four ceased to register; one of them being a sulphate-works. There are now 101 works registered in this district as "gas liquor works" for the manufacture of sulphate, muriate, or carbonate of ammonia, or the concentration of liquor. At the date of the report, there was considerable activity in the colliery districts of South Yorkshire and North Derbyshire, accompanied by the erection of coke-ovens with plants for the recovery of products. Mr. Jackson gives particulars of the new sulphate of ammonia works, upon one of which he makes the following observations.

This is a large plant on the usual continuous system, with fishing saturator, superheater, tubular condenser, water-cooled. The saturator gases then pass through a coke scrubber to a Claus kiln and chambers. The hot or first end of the sulphur chambers is detached from the cooler portion; connection being made between the two sections by a suitable flue, as is now usual in the best plants on this principle. This modification was, I believe, first suggested and adopted by Mr. Alfred Colson, Engineer to the Leicester Corporation Gas and Electric Lighting Department, at the Aylestone Road works. Unfortunately, there is always contraction and expansion of the brickwork taking place at the end of the chambers nearest to the kiln, due to the stopping and re-starting of the plant, necessitating frequent repair and rebuilding in order to maintain this portion of the apparatus gas-tight. This plan, however, by keeping the parts detached in the manner described, largely prevents the damage resulting from this heating and cooling of the brickwork extending to the portion of the chambers farthest away from the kiln. (In building these chambers, strong bracing of the brickwork is most important.) At these new works, the usual limestone tower is attached, with two final oxide of iron purifiers. These purifiers are built of bricks laid in cement, with cavity walls filled in with cement. The devil liquor is returned to the crude ammoniacal liquor well. A hydraulic change valve is put in.

The continuous method of distillation is used in 90 works; and the proportion of liquor treated in this way is 98 per cent.

In this district 26 works are registered for the distillation of tar. Important modifications in the methods of dealing with the uncondensed gases from the worm-ends of the stills and the vapours thrown off from the hot pitch as it is run from the stills into the coolers were not made last year in many of the works; but at one of them very great improvements were carried out. The plant, including all the store tanks, was put under suction, and at a considerable vacuum. Additional condensers were erected, so that all vapours from stills, coolers, and store-tanks were made to pass through the condensers and an oxide of iron purifier before escaping. Three new works were registered. Two of them are, however, only very small; prepared tar for the manufacture of tar-macadam only being produced. The remaining new works are very large, with a range of ten stills. The worm-end gases from the heaters and stills are drawn away and burnt under the steam-boilers. The hot vapours given off from the pitch as it runs into the coolers from the stills are also drawn to the boiler fires, and there burnt.

Seven new sulphate of ammonia works were registered last year in the district supervised by Dr. Alfred C. Fryer, which comprises the South-West of England and South Wales. Altogether, there are 80 works registered where the manufacture of sulphate and muriate of ammonia is carried on; and the total quantity of ammoniacal compounds produced during the year amounted to 11,086 tons, calculated as sulphate of ammonia. During the year, three large new plants for the recovery of the bye-products from coke-ovens were registered in the district; two being situated in Glamorganshire and one in Monmouthshire. Dr. Fryer says that the plant erected at Bargoed by the Powell Duffryn Steam Coal Company is complete in every detail; and it is noteworthy to record that the sulphuretted hydrogen generated in the manufacture of sulphate of ammonia is to be afterwards utilized in the manufacture of sulphuric acid. This is the second bye-products plant in the United Kingdom which has, as yet, had a vitriol plant added to the process. The year's returns show that there is an increase of 42 per cent. of sulphate of ammonia made at the bye-product plants over that produced in 1904. Besides the three sulphate plants erected at the bye-product works, four new registrations took place at gas-works for this manufacture. All these four new plants are suitably equipped with oxide of iron purifiers for absorbing the sulphuretted hydrogen generated. An ingenious arrangement of forming two circular oxide of iron purifiers out of a disused tar-still, by cutting it into two halves, has been adopted at one works. The distillation of tar is carried on at eleven works in the district; but there were no important changes to record.

We now come to the last district—that comprising the Eastern and South-Eastern counties—of which Mr. F. Napier Sutton has the super-

vision. In this district there are carried on 92 processes connected with the manufacture of sulphate of ammonia and 19 with the distillation of tar. The visits paid to registered works in the course of the year numbered 681. The number of tests made of gases escaping from the chimneys, flues, and process plants was 721. These figures show an increase of 59 and 35 respectively on the numbers for the previous year. The total quantity of ammoniacal compounds manufactured in the district during the year was 48,099 tons (in terms of sulphate)—a further drop of 14 tons on the amount produced in 1904, when for the first time a slight decreased yield of 9 tons was shown. The products manufactured consisted chiefly of sulphate, but included carbonate and nitrate of ammonia, as well as liquid (refined) and anhydrous ammonia. With the exception of a few hundred tons obtained in the manufacture of animal charcoal, the whole of the production is derived from the carbonization of coal in gas making. The gas-works belonging to companies and local authorities furnished 88·7 per cent. of the products, and the balance of 11·3 per cent. was made in the works of private firms. The figures given above show but slight variation between the two years under comparison.

The very large proportion of the sulphuretted hydrogen evolved in the distillation of gas liquor, amounting to 68 per cent., is converted direct into sulphuric acid. The works having means for this purpose only number six, three of which belong to the larger Metropolitan Gas Companies. Mr. Sutton says it is not likely that the number of these works will increase, as only exceptionally large gas companies are in the position to manufacture acid; and the number of private firms making both acid and ammonia compounds is necessarily limited. The process dealing with the next largest proportion of foul saturator gases is the Claus sulphur-recovery process, by which 12 per cent. of the sulphuretted hydrogen evolved in the district is converted by limited oxidation into sulphur. The method is in use at seven works as hitherto, and eight units of plant were in regular use.

Purification of the saturator gases by oxide of iron is in operation at 62 works in the district; but the proportion of gas so treated only amounts to 8·9 per cent. of the whole. The majority of the works using this method are small; and the oxide purifier is undoubtedly the easiest and most reliable means available for a small works. The average annual production of sulphate at the works using the method is 68 tons; but the make varies from 288 tons at the largest to 6 tons at the smallest works. Further experience of the oxide "heap" purifier has confirmed the view expressed previously, that this form of purifier is highly effective and economical; it is best used in the open, without any overhead protection. The number of works at which the "combustion neutralization" method is used for dealing with the sulphuretted hydrogen remained the same as last year. The proportion of foul gas treated at the nine works using the method was 7·8 per cent., and showed a slight increase on preceding years. The average make of sulphate at these works is 418 tons, while the amount at individual works varies between 103 and 1150 tons. The method is suitable not only for works on a scale too large for economical oxide purification, but where other approved means for the utilization of the sulphur ingredients of the saturator gases are unavailable. It is not to be recommended for works with a make of less than 250 tons of sulphate per annum, unless special reasons exist, such as the necessity of producing an effluent liquor of modified character and appearance.

Mr. Sutton refers to the increasing difficulty experienced in the disposal of the spent liquors by reason of the objection taken by local sanitary authorities to receive these refuse liquors into the sewers. Objection is raised chiefly in cases where the district sewage is treated by bacteria filter-beds. The presence of sulphocyanide and phenoloid bodies in the spent liquors is the chief cause of their objection. Mr. Sutton says:

> In two instances the local authorities have taken absolute objection to receiving the sulphate-works effluent into their sewers, with the result that the manufacture at one works was abandoned during the entire past year, and the ammoniacal liquor sold for manufacture at a distance, involving considerable loss to the company. In the second case, the sulphate manufacture was only commenced in the past year; and though the plant had been most carefully designed to ensure the utmost freedom from objection, the local authorities forbade delivery of the effluent to the sewers. In consequence of this attitude, the gas company have since adopted a process designed to remove the sulphocyanide from the spent liquor, and to yield a clear, colourless effluent; and it is hoped that the prohibition to the discharge to the sewer may, in consequence, be withdrawn. The process for the removal of the sulphocyanide involves additional supervision and the use of expensive reagents, and the cost on the original manufacture is therefore increased to a considerable extent, while the plant can only be worked at such speed that the waste liquors can be dealt with and entirely used up in the works.

The distillation of tar is carried on at 19 works of varying capacity. One or two additional pot stills were erected last year, which brought up the distillation plants employed in the district to 112 intermittent pot stills and three of Leonard's patent continuous stills. Mr. Sutton says the appliances with which all the still receivers are now fitted for draughting and destroying the permanent gases evolved at the worm-end have generally been found in effective use. Only in one case was there reason to complain of neglect to employ the appliances provided. Difficulty arose at times at two works when treating unmixed tars, of peculiar character, containing exceptionally large quantities of naphthalene. The condensing water in the worm-tanks requires to be kept very hot during the fractionation of the creosote distillates, to prevent choking of the worm by naphthalene; and, in consequence, the amount of uncondensed vapour evolved at the worm-end is more than can be effectually dealt with by the draughting appliances. It is only when treating these unmixed tars that the difficulty occurs.

We have now only to deal with the Chief Inspector's report to the Secretary for Scotland, which consists to a large extent of a report by Mr. W. S. Curphey. The number of works registered last year was 137, or four more than in 1904; and the processes under inspection were increased by the latter figure—from 214 to 218. The quantity of sulphate of ammonia made was 91,028 tons, the various sources being: Gas-liquor works, 17,953 tons; iron-works, 19,594 tons; shale-works, 46,344 tons; producer gas, coke, and carbonizing works, 7137 tons. The number of registered works in which sulphate, chloride, or hydrate of ammonia was made last year was 77, or four more than in 1904. These works comprised 16 iron-works, 12 shale-works, 7 coke, producer gas, or carbonizing works, and 42 gas-liquor works. There was an increase in the production in each class of works, though in iron-works it was not great. No extension of plant for the recovery of ammonia or change in methods took place during the year. The higher yield was due rather to increased activity in the manufacture of pig-iron; in addition, the average output per furnace per week was slightly greater. In shale-works the increase was more marked, amounting to 3858 tons, which might be taken as an indication of increased activity in this industry. In works utilizing gas-liquor, an increase of 1268 tons is to be noted—pointing to a steady growth in the manufacture of illuminating gas. In works classed as producer gas, coke, and carbonizing works, the increase, amounting to 2377 tons, although not absolutely, is relatively, the largest. It is due to the extended use of coke-ovens, and to the extension of Mond gas plant, with recovery plant attached. Mr. Curphey says a further extension in this class of works is to be looked for in the near future.

No new methods were introduced for dealing with the waste gases arising in the manufacture of sulphate of ammonia. In shale-works, the practice continues of sending the waste gases and steam to the retorts. In iron-works, the ammoniacal liquor is practically free from sulphuretted hydrogen. In works utilizing gas liquor, combustion is still practised in four works. In three of these, it is used for a portion only of the waste gases; sufficient space not being available for purifiers of adequate area. In the fourth, a small sulphate of ammonia plant has been erected in a large engineering works, where the burnt waste gases are largely diluted before reaching the atmosphere.

The number of registered works in which tar was distilled last year was 41, or one less than in 1904. One small plant was put out of operation. The use of the lime purifier for dealing with the noxious gases given off during the distillation of tar was general, as in former years. In one works, a fume condenser was provided to prevent the escape of fume from the pitch-cooler while the stills were being run off. The general condition of these works remained satisfactory.

In the concluding portion of his report, Mr. Carpenter directs attention to the remarkable improvements effected during the past decade in retort plant employed in the distillation of shale. He points out that not only have the expenses of retorting been reduced, but concurrently the operation of these large units of plant has lessened local escape of noxious and offensive gases on the discharge of the spent material. He says it may also be now confidently affirmed that the yield of ammonia has not only not lessened but has increased. He has compiled the figures in the table below from the statistical returns on Mines and Quarries issued by the Home Office.

Year.	Total Shale Mined in the United Kingdom.*	Total Sulphate of Ammonia Recovered from the Shale.	Yield per Ton of Shale Mined.
	Tons.	Tons.	Lbs.
1896	2,419,525	37,822	35·0
1897	2,223,745	37,153	37·4
1898	2,137,993	37,264	39·0
1899	2,210,824	38,780	39·3
1900	2,282,221	37,267	36·6
1901	2,354,356	40,011	38·2
1902	2,107,534	36,931	39·3
1903	2,009,602	37,353	41·6
1904	2,333,062	42,486	40·8
1905	2,496,785	46,344	41·6

* A certain amount of shale is used in gas-works in place of cannel for raising the illuminating value of gas.

The comparison of the figures for 1896 and 1905 is interesting. Mr. Carpenter says that while it is necessary to bear in mind the variations of quality in shale both as regards oil and ammonia yield, and therefore to make allowance for the fact that precisely the same things are not being compared when looking at the column of shale mined, yet the law of average also has an equalizing effect on such large totals, and the influence of the new factor alluded to above certainly has made its mark.

The number of small works manufacturing sulphate of ammonia from gas liquor tends to increase. These are principally at gas-works, where, Mr. Carpenter says, the manufacture is now better understood and in greater favour with managers. The duties of the inspector, however, are still onerous. In regard to plant construction and equipment, the obligations of the Alkali Acts have generally been found to be satisfactorily complied with when registration of the works is applied for. There is sometimes a tendency shown to cramp the purifier space, and to provide what experience subsequently shows to be not an economical amount, considering the output of the plant. A prior analysis of the gas liquor to be employed should, he says, be at the disposal of those who design the plant in any particular case. Too often, however, it is found that ignorance prevails on this important factor, which alone can determine what amount of noxious and offensive gases may be looked for. On putting the plant into operation, moreover, a tendency is sometimes found to press it beyond the capabilities of the portion which deals with the foul gases evolved. This may happen after some years in old-established plant with the exigencies arising from an increased make of liquor. In such cases, the inspector has not unfrequently to call attention to neglect of the oxide purifiers, which, under such circumstances, may foul with great rapidity, allowing the escape of noxious and offensive gases. Mr. Carpenter thinks it is necessary to enter a warning here upon the consequences that must ensue—involving penalties—for repeated instances of such neglect, and obliviousness of the warnings conveyed.

The distillation of gas liquor under considerably reduced pressure continues in successful operation at two works. The amount of noxious and offensive gases to be dealt with does not suffer any reduction by operation of the vacuum process. This in no way interferes with their subsequent treatment by any of the approved methods; and the liability to local escapes of such gases on the vacuum side of the pump —*i.e.*, from the whole apparatus connected with distillation and the conversion of the ammonia into sulphate—is quite done away with.

PROVINCIAL GAS AND WATER COMPANIES.

Gas.

Jubilee of the Farnworth Gas Company.

The Farnworth and Kearsley Gas Company have just celebrated their Jubilee; the hundredth half-yearly meeting of shareholders having been held on Thursday—Alderman J. Fletcher presiding. The Directors in their report stated that the profit on revenue account was £3075, which with £400 brought forward made £3475 to carry to the profit and loss account. Dividends of 10 per cent. on the "A" stock, and 7 per cent. on the "B" stock and "D" shares were recommended. In moving the adoption of the report, the Chairman said the Company had arrived at the height of their financial prosperity. The reserve fund was at its maximum, and the security of the shareholders had passed from the uncertain stage. His view of the management was that all economies for the benefit of consumers had been introduced, and should go to the reduction of the charges for gas. The works (which are under the supervision of Mr. H. Pickford) were equipped in the most modern manner; and the Directors did not know what else could be done to improve the Company's standard as a trading concern. They wished to lay stress upon the fact that the question of discontinuing meter-rents was not one which concerned the works, but was simply a matter of equity as between consumers of gas and electricity. The Company had decided to reduce the price of gas from the September quarter as follows: Consumers up to 300,000 cubic feet, 2s. 6d. net, a reduction of 2d.; consumers of 300,000 cubic feet and upwards, 2s. 2d. net, a reduction of 4d.; and for manufacturing and power purposes, 2s. 2d. net, a reduction of 4d. The loss of revenue by the reduction would be £1295 per annum. The increase in the consumption during the past year was 5½ per cent.; and it was the highest recorded.

Increased Output at Harrogate.

The half-yearly meeting of the Harrogate Gas Company, held under the presidency of Mr. S. Hornby last Tuesday, was an uneventful gathering. The Chairman was able to tell the shareholders that the six months' working to June 30 had been successful, and that the output of gas had been 5 per cent. more than that of the corresponding period last year. This result was achieved in the face of an extensive introduction of incandescent in place of flat-flame burners. After a formal resolution had been adopted to pay interim dividends, a vote of thanks was accorded the Chairman, Directors, and officials of the Company. The Chairman responded, as did also Mr. H. Wilkinson, the Secretary and General Manager, on behalf of his colleagues and himself.

A Prosperous Year at Hartlepool.

The report submitted at the annual meeting of the Hartlepools Gas and Water Company stated that the total revenue for the year ended June 30 was £89,579, and the expenditure £53,750; leaving a balance of £35,829 to the credit of profit and loss account, out of which £3606 had been paid for interest on loans, and £15,724 for interim dividend in March last. The Directors recommended the payment of a dividend for the last half year at the rate of 5 per cent. per annum on the whole of the paid-up consolidated capital of the Company, less income-tax. The £10,000 of ordinary stock sold by auction in May realized £12,552. In moving the adoption of the report and balance-sheet, the Chairman (Mr. Thomas Appleby, J.P.) congratulated the Directors and shareholders upon having had another prosperous year, which enabled the Board to declare the maximum dividend and to carry forward a balance of £762. The cost of the production of gas during the current year would be greater than in the past, because of the advanced price for coal which the Company had to pay; but with due economy, the Directors trusted that it would not be necessary to raise the price to the consumers. The revenue derived from gas and water showed a distinct increase; and this, he thought, was very satisfactory, considering the depressed state of trade that had existed throughout the district during the past twelve months. He was pleased to say that this depression seemed less acute at the present time; and while shipping had not improved, nor was it likely to improve in the immediate future, other trades in the district were certainly better. This meant more employment for the working classes, fewer empty houses, and a corresponding increase in the Company's revenue. In regard to slot-meters, this part of the Company's business continued to expand; and during the year, 515 new consumers had been added to the list. The number of consumers under this system was now 6959, who last year paid £7355, representing over 1¾ million pennies. Most of the residual products had yielded good returns; tar being the least favourable. This was accounted for by the number of coke-ovens built by various collieries, all of which produced great quantities of tar, which, though not of so high a quality as gas-works tar, was sure to have an effect on the price of that product. Sulphate of ammonia had maintained a firm tone throughout the year, and as a manurial agent was now thoroughly established in the very highest class of fertilizers. The production of sulphate of ammonia in the British Isles steadily increased, not only from gas-works, but from collieries which had put down coke-ovens; and it now amounted to over 250,000 tons per annum. In view of this large output, it was very pleasing that such favourable prices continued to be realized. He wished that he could congratulate British agriculturists upon a more general use of sulphate; but it was Japan, Spain, and other countries which were taking by far the largest proportion of their output. It was true that different classes of soils required different treatment, both as regarded their proper working and also their manuring; but he believed that by a judicious mixing of sulphate of ammonia with other fertilizers suitable to the land, much better results might be obtained. Considering that it was entirely a product of home manufacture, it was to be hoped that local agriculturists would avail themselves of it more freely in the near future. With reference to incandescent lighting, the rapid growth of this system had considerably strengthened the position of gas companies; and he looked forward to a vastly-increased demand for this system of lighting in the future. The quantity of water available for both domestic and trade purposes was more than sufficient to meet all present requirements. In conclusion, the Chairman remarked that he would like to remind the local spending authorities how necessary it was that strict measures should be adopted to keep in check the ever-increasing expenditure for local purposes. The Company's rates had increased during the past ten years to the extent of over £2000 per annum; and there could be no doubt that such increases had a strong tendency to check the development of trade. The report and balance-sheet were approved.

Gas Supply in North London Suburbs.

The reports presented at the recent half-yearly meetings of the North Middlesex and Southgate and District Gas Companies show good progress in the case of each undertaking in the six months ended the 30th of June. The former Company had an increase of 11½ per cent. in the sales of gas, and the rental was £1470 higher, in comparison with the first half of the past year. The net profits amounted to £3639, which added to the £2019 brought forward made the disposable balance £5658. Out of this, dividends at the rates of 5 per cent. per annum on the preference capital, and of 10 and 7 per cent. per annum respectively on the original and additional ordinary capital, were declared; and a sum of £473 was carried to the reserve fund. This appropriation amounted to £3507, and left £2151 to the credit of the profit and loss account. The Southgate and District Gas Company had in the past half year an increase of 3·8 per cent. in the sales of gas, which yielded £343 more than in the corresponding period of 1905, and residuals produced £125 more. The amount available for distribution was £3929; and dividends for the six months at the same rates as in the case of the neighbouring Company were declared. The payment of these required £2395, and left a balance of £1534 to the credit of the profit and loss account.

More Advice to Shareholders to be "Watchful."

The Chairman of the Tonbridge Gas Company (Mr. J. Fagg) did well, at the half-yearly meeting on Monday last week, to reiterate the warning given to shareholders by other chairmen of gas companies against having anything to do with new gas companies which are being formed with large capitals to exploit small villages, and the promoters of which are sending broadcast rosy prospectuses. He quoted the remarks made on this subject by Mr. H. E. Jones, at the recent meeting of the Wandsworth and Putney Gas Company. The Directors reported a steady increase in the consumption of gas, and a slight improvement in residuals. The Engineer, Manager, and Secretary (Mr. James Donaldson) reported that the works and plant had been maintained in a satisfactory condition. The balance for the six months was £2406, which added to the amount brought forward (£4162) made a total of £6568 available for distribution. Out of this, the Directors recommended the payment of dividends at the rates of 12, 9, and 5 per cent. per annum, on the several stocks. In moving the adoption of the report, the Chairman said the past half year had been a very good one; and though he had nothing very eventful to relate, he was happy to say they were still progressing. Not much had been done in the way of new works or plant; but the accounts showed that the Company were profiting now by what had been done during the past few years. The report was adopted. In acknowledging a vote of thanks, the Chairman said it was a great pleasure to him that the affairs of the Company were so prosperous; and he should like to thank Mr. Donaldson, who was always looking out for some means of improving the works and plant, and also his co-Directors, for their support.

No Water Gas for Wolverhampton.

At the ordinary general meeting of the Wolverhampton Gas Company last Tuesday, the Directors reported that the accounts for the past half year showed a net profit of £9832. This sum, added to the balance brought forward, enabled them to recommend the payment of dividends at the same rate as before—viz., 3 per cent. on the preference stock, £5 2s. 6d. per cent. on the consolidated stock, and £3 2s. 6d. per cent. on the new ordinary stock, less income-tax—and to carry the balance of £459 to the reserve fund. They further recommended that £204 14s., interest for the half year, should be placed to the credit of the reserve fund, and a sum of £42 14s. 7d., also interest, to the credit of the insurance fund, and the balance of £7215 carried forward to the next account. The Chairman (Mr. B. O. Clark), in moving the adoption of the report, referred to the subject of water gas, and stated that the question of making it had been before the Directors three or four years previously, and they came to the conclusion that it was not necessary. Alderman Jones urged the Board to do all they could to improve their resources, as the electric light was a strong force against them in Wolverhampton. The Chairman said there were something like 10,000 penny-in-the-slot meters, gas-stoves, &c., in use, which were paying the Company very well indeed. The report was adopted, and the dividends recommended were declared.

Water.

New Works for Gosport.

The ordinary general meeting of the Gosport Water Company was held last Wednesday; the chair being occupied by Mr. W. E. Churcher. The report presented was again one of a favourable nature, showing that the total water-rental was £4387—an increase of £99. The sum of £2531 was carried to the profit and loss account, bringing it up to £7106. The Chairman congratulated the shareholders upon the continued prosperity of the Company, and stated that the Engineer had reported that good progress was being made with the new scheme of obtaining a water supply from Soberton. Preliminary steps would be taken shortly for building the covered service reservoirs on the Company's land at Shedfield. The report was unanimously adopted; and it was determined that full statutory dividends should be paid. They were 3½, 4½, and 5 per cent. on the various descriptions of stock; and after their payment there would be left a balance of £666.

Rebates on Water Rates and Sales at Luton.

The half-yearly general meeting of the Luton Water Company was held at the Town Hall last Thursday. In the report presented by the Directors, it was stated that a rebate on water rates and sales had

been allowed at the rate of 20 per cent. The revenue account showed that after payment of the maximum dividend, and a transfer of £112 to the reserve fund, there remained the sum of £1179 to be carried forward. The Engineer (Mr. W. R. Phillips) reported that the engines, pumps, and boilers were all in good working order; and that the condition of the buildings, mains, reservoirs, and towers had been fully maintained. The water-rates amounted to £5129, compared with £4906 in the corresponding period of 1905; and the water sales to £1635, against £1324. After allowing for the rebate already referred to, the receipts stood at £5411, compared with £5140 for the corresponding half of last year. The balance carried to the net revenue account was £3234; and with £130 derived from interest on money invested, and £899 brought forward, the sum available for distribution was £4263.

Water Companies' Heavy Assessments.

At the meeting of the South Staffordshire Water-Works Company last Thursday, the Directors reported that the number of houses laid on in the six months ending the 30th of June was 1304; making the total supplied 129,544. The gross amount of water-rates was £67,678, against £64,833 in the corresponding period of the previous year. After providing for interest on the debenture and preference stocks, the amount remaining for division (including £5599 brought forward) was £28,580; and the Directors recommended the declaration of a dividend on the ordinary stock at the rate of 7 per cent. per annum, less income-tax. The amount of the dividend being £22,111, there remained £6469 to be carried forward. The report of the Engineer (Mr. H. Ashton Hill, M.Inst.C.E.) as to the condition of the works and plant was that they were in substantial order and repair. The Chairman (Mr. Frank James), in moving the adoption of the report, directed attention to the profit and loss account; pointing out that the engine charges had increased by £932, due to the greater bulk of coal used in pumping an increased volume of water. The item for maintenance of works was raised by £787; but this represented expenditure that might have been charged to depreciation. Their old friend the rates claimed £6741; and he was afraid there would be a further increase, for one or two Unions had asked for particulars with a view to a reassessment of the Company's property. In common with railway companies, water companies suffered from inequitable assessment. Bankers had only to pay rates on the value of their premises, no matter how many thousands of pounds profit they made; but water companies were rated on their profits, and had to pay rates in parishes where they had not a shilling's worth of visible property. Their mains passed through the parish underground, and gave the authorities no trouble at all. He would not complain so much if the money was spent in the parishes where it was earned by the Company; but he supposed he should have to go on grumbling till someone formulated an equitable scheme of assessment. The balance of profit was £28,580, against £26,435 for the previous half year. On the capital account the expenditure during the six months was £20,655, which went in new pumping stations and enlarged mains. This expenditure would go on for some considerable time. Work now in progress would cost about £33,000. Including what had been done and what was to be done, they had to provide for a capital outlay of nearly £50,000. But they already had authority from Parliament and from the shareholders to issue shares and debentures to the value of £80,000; and they might avail themselves of some of this unissued stock during the coming half year. To show the progress of the Company during the last ten years, he pointed out that in 1896 the dividend was 5½ per cent., which amounted to £15,217, and left a balance of £4247. This year there was a dividend of 7 per cent., which amounted to £22,111, and left £6469 to be carried forward. If they did as well as this during the next ten years, they would not have done badly. The motion was carried unanimously.

HATHERSAGE AND DISTRICT GAS SUPPLY.

An Excellent Prospect for the New Company.

The First Statutory Meeting of the shareholders of the Hathersage and District Gas Company, Limited, was held on Thursday, the 23rd ult., at the offices of the Secretary, Mr. Robert Hall, at Matlock. Mr. Ambrose Firth, of Sheffield and Bamford, the Chairman of the Board, presided; and among the Directors present was Colonel Shuttleworth, a resident at Hathersage. The report showed that the total number of shares allotted was 10,000, at £1 each, and that altogether £4896 10s. had been paid on them. The preliminary expenses accounts, which totalled £342 19s. 3d., were passed; and it transpired that the officials appointed include Mr. George W. Cross as Manager and Mr. F. D. Stones as Accountant. The Engineer (Mr, T. Brown, the Engineer and Manager of the Matlock and District Gas Company, Limited) made his report on the progress of the works, which are being erected at Hathersage. The road has been completed as far as the entrance; the foundations of the buildings for the offices, stores, and workshed are already in, ready for the stonework to be commenced; the retort-house foundations are in on three sides; and the gasholder is almost ready for the tank. In reply to a shareholder, the Engineer said they would be in a position, it was hoped, to start supplying gas by the middle of November next; and the prospect of a large number of consumers was excellent in the area of the Company's supply. He believed everything to be progressing in an encouraging manner. Colonel Shuttleworth said he could inform the shareholders that the buildings were proceeding very satisfactorily indeed, and that the work (for the whole of which Messrs. J. Firth Blakeley and Co., of Dewsbury, are the Contractors) was quite up to his expectations. Mr. Tom Wright, J.P., remarked that the shareholders were pleased to hear this from a gentleman residing on the spot. He (Mr. Wright) believed the undertaking had a very successful future in store for it. He moved a vote of thanks to the Chairman. Mr. Firth, in acknowledging the vote, said he had great anticipations of the Company's future. The certificate of registration and other official documents were laid before the meeting in the usual course; and the proceedings closed.

ASCOT DISTRICT GAS AND ELECTRICITY COMPANY.

The New Electricity Supply Powers.

The Ordinary General Meeting of this Company was held on Tuesday last at the London Offices, No. 50, Cannon Street, E.C.—Mr. JOSEPH MANWARING in the chair.

The SECRETARY (Mr. W. A. Schultz, F.C.A.) read the notice convening the meeting; and the report and the accounts for the half year to June 30 were taken as read.

The CHAIRMAN, addressing the shareholders, said when he last had the pleasure of meeting them, he had to refer to a slight decrease in the output of gas. He was glad, however, on this occasion to be able again to refer to an increase in the output for the half year, as against that of the corresponding period of 1905. It would also be borne in mind that, as this was an increase in the money value, it was a still greater increase in the actual output, seeing that the price of gas had been reduced by 3d. per 1000 cubic feet all round as from Jan. 1 last. Since the shareholders last met, the Bill the Company promoted in Parliament had passed, having received the Royal Assent on August 4. Under the provisions of the Act, the Company's name had changed from the Ascot District Gas Company to the Ascot District Gas and Electricity Company. Although at their last meeting there were a number of petitions on the file against the Bill, he was very pleased to say that these were all withdrawn after negotiation with the various petitioners. That of Messrs. Foote and Milne was withdrawn, owing to the Board of Trade refusing sanction to their application for a Provisional Order for the same district. He thought credit was largely due to their Parliamentary Agents (Messrs. Lees and Butterworth) in having successfully piloted the Bill through its various stages. Their Secretary (Mr. Schultz) also gave a very great deal of time and personal attention in this matter, in frequent consultation and negotiation with the various parties interested, and with the Parliamentary Agents. Their thanks were due to him for his attention to the interests of the Company; and, as would be seen by the report, the Directors had unanimously decided to ask the shareholders to grant an honorarium of 125 guineas to him for these special services. The Company were now in the unique position of possessing electric powers after having wielded those of gas for 24 years. But he thought the shareholders need have no apprehension but that the Directors, with their sanction, had taken the proper steps and at the proper time. There were a large number of houses in the neighbourhood of Sunningdale that had already been wired for the reception of electricity; and had the Company not taken the powers, it was more than probable that the various would-be consumers would have established their own electric light plant, either separately or in co-operation with their neighbours. The Directors would, in the immediate future, take steps to ascertain the requirements of the inhabitants of the neighbourhood so far as electricity was concerned; and he had no doubt the result would fully justify the prompt application of the powers contained in the new Act. With these few remarks, he begged to move that the report of the Directors, together with the accounts, be adopted.

Dr. H. J. STRONG seconded the motion.

Mr. SAMUEL SPENCER said that, considering the reduction of price the Directors had made, he thought the balance-sheet was, on the whole, very satisfactory. He rose, however, more particularly to express his concurrence with the honorarium to Mr. Schultz that the Board proposed.

Mr. F. R. SMITH said he noticed in the capital account an item of £155 "costs of Bill in Parliament." Were these the total costs?

The SECRETARY explained that the sum charged was the amount of the costs paid up to date. The remainder of the costs would appear in the accounts next half year.

Mr. SMITH remarked, with regard to the proposed honorarium to Mr. Schultz, that he knew their Secretary had been put to a great deal of trouble in interviewing opponents to the Bill; and he entirely approved of the suggestion of the Directors. The Company were indeed to be congratulated in getting the Bill, with its electricity powers, through so satisfactorily.

The motion was unanimously carried.

Proposed by Mr. SPENCER, and seconded by Mr. WEBB, it was resolved that a dividend at the rate of 5½ per cent. per annum be declared for the half year, less income-tax.

Most cordially the shareholders passed the next resolution, submitted by the CHAIRMAN, and seconded by Mr. SPENCER—"That, in consideration of the extra time and attention given by the Secretary to the passage of the Company's Bill through Parliament, he be granted an honorarium of 125 guineas for these special services."

Mr. SCHULTZ asked to be allowed to express his thanks for this honorarium in recognition of his services. He could only say that he did put his best efforts into getting the Bill carried through Parliament, and not only so, but to get it through at the smallest possible expense to the Company. They must now go to work carefully, and not waste their energies or capital; and when they found there was a real demand for electricity, they must go ahead, and give the supply. It could not matter to them whether they supplied gas or electricity. Their duty was to supply artificial light; and it made very little difference how they manufactured that light. They had a staff and an Engineer (Mr. A. E. Brooks); and so were well equipped in every way. Mr. Brooks was not an Electrical Engineer at present; but he had made up his mind to study electricity, and to pass an examination in the subject. This reflected great credit on him.

A hearty vote of thanks was passed to the Chairman and Directors and the officials; and a response from the Chairman on behalf of the Board, and from Mr. Brooks for the officials, terminated the proceedings.

Reduction in Price at Douglas.—The half-yearly meeting of the Douglas Gas Company was held last week; and a dividend of £1 12s. 6d. per share was declared, and £500 placed to reserve. A reduction of 2d. per 1000 cubic feet—to 2s. 8d.—was made in the price of gas.

THE FATALITY AT THE COVENTRY GAS-WORKS.

Close of the Inquest.

The explosion which occurred at the Coventry Gas-Works on Sunday, the 8th of July (see *ante*, pp. 132, 196), was further inquired into last Tuesday, when the inquest on Edward Howarth, the carbonizing foreman at the works, was resumed by the Coroner, Dr. C. W. Iliffe. Mr. G. E. Duckering, H.M. Inspector of Factories, was present. It may be remembered that Howarth, in company with Mr. Joseph Winstanley, the Works Manager, was searching for an escape of gas when the accident happened. Both men were badly burned, and Howarth died the next day; but Mr. Winstanley, after lying in a critical condition for some time, was only sufficiently recovered to attend the inquest on Tuesday. The evidence given at the previous hearing (see *ante*, p. 256) showed that on Saturday, the 7th of July, the annual excursion of the workmen took place, and that on the previous evening an order was given by Alexander Stewart, the general yard foreman, for the box of No. 5 purifier to be emptied in the usual way. From some cause, the cover of the box was not properly cemented down, and there was an escape of gas. It was in the endeavour to locate the source that Mr. Winstanley went into the purifying-house, followed by two of the workmen, one of whom was carrying a lamp. Immediately afterwards there was a violent explosion, with the result stated.

Alexander Stewart was recalled, and, in reply to the Coroner, said he had never received any printed instructions as to his duties. He had been at the works rather more than four years, and had charge of the purifiers, the preparation of the oxide, the superintendence of the carting and stacking of the coal, the carting of the coke, and other matters. He had under him this summer 80 yard men and 15 horse men; but in January he had 118 and 24. It was not possible for him to see to every detail; he had men in charge in all the departments. After speaking to the charge man respecting the turning of the box, the man said: "You get Jimmy Johnson to mix up the muck, and I will see to the lid." Witness gave Johnson the order to mix the cement, and left it on the bench. He went into the place about twelve o'clock, and found they were putting on the cover of the purifier. He waited until everything was secure, then asked Aldridge (the charge hand) if everything was all right, and he said it was.

This evidence was corroborated by a witness named Pulford.

Mr. *Joseph Winstanley* was the next witness. He spoke to being informed by Stewart as to the purifier being emptied; and later he was told that the cover had been put on. About eight o'clock on Sunday night, he was informed that no gas could be got into the holder. He did not think there was anything seriously amiss at the time, but told the men to send for him at his house if anything was wrong. However, he was not sent for, and he returned to the works at ten o'clock, when he found that the meter was still working backwards. He told the men that if they would bring him a light he would have a look round. The lamp produced [an Armstrong] was brought to him, and they went to the pressure-room, finding that there was a pressure of only 6 inches. Witness afterwards visited the purifying-house to see if he could detect an escape of gas. He started by himself, and did not take a lamp, as he would not require any light to do what he wanted to do. When he got into the house, he saw that three men were following him, one of whom had a lamp. There was nothing which witness detected that seemed to make it dangerous to take a lamp into the purifying-house at that time. He had, however, only got to the fifth purifier when the explosion took place. Witness was questioned as to two electric lamps which he said had been ordered by the General Manager. One of these was kept at his house, so that he could use it when called to the gas-works during the night; the other was kept at the works. Neither of these lamps had been used during the summer, and neither had been recently recharged.

In reply to the Inspector, witness said he had heard of the explosion at the Saltley Gas-Works; but he did not know at the time that the Armstrong was the type of lamp responsible for it.

The Inspector: You must have had some reason for introducing the electric lamp?

Witness: The reason was because they were more handy.

Did you ever have cause to mistrust the Armstrong lamps?—No; I have always carried them.

Then why did you displace them for the electric lamp?—Mr. Stevenson did so; I did not.

Have you considered the question of danger in the use of lamps in the case of gas-works?—I have always considered the Armstrong lamp safe.

After the Saltley explosion?—I did not understand from the Saltley explosion that the Armstrong lamp was unsafe.

I think you are behind the times, if what you say is correct. The lamp has been proved to be dangerous where gas is escaping. You have had no instructions from the Inspector of Factories?—None.

Do you still believe the lamp to be a safe one?—No. Witness further explained that he had no intention of taking a lamp into the purifying-house, as what he wanted to do he could have done without a light.

The Coroner: Except through the misfortune of the men following you with a light, there would have been no explosion?

Witness: I do not suppose there would.

Mr. *Fletcher W. Stevenson*, the Engineer and Manager, was next called. He said he ordered the electric lamps immediately after the Saltley explosion. He intended the old lamps to be discarded, and the electric lamps used in all dangerous places. He discussed the matter with Mr. Winstanley, and he agreed that the old lamps were out of order. He (witness) had no idea that they were not duly recharged. His only regret was that they had not been broken up.

The Coroner: The very things that would have saved the situation were out of order.

The Inspector, in addressing the Jury, said they had a gas-works in Coventry situated in a crowded district and of a peculiar type. It was a heavy building. They had to consider what might happen under these circumstances. They had a purifying-house which was solidly built, and in which there was very little ventilation. It therefore behoved everyone connected with the management to take special precautions to prevent explosions. But they had lax management all through. They had a yard foreman who did not know what the respective duties of the two charge men under him were; and they had a Works Manager who had no idea what these charge men were doing or what their duties were. They had it from him that he had never considered much the use of safety lamps in gas-works; and, having regard to the many explosions which had taken place, this was a very important matter. This lamp was a very dangerous one; and after the Saltley explosion certain recommendations were made that only electric lamps should be used in dangerous places. A purifying-house was a dangerous place, and the one at Coventry more so than many. If the Jury found they could make a recommendation, he should ask them to do so.

The Town Clerk (Mr. G. Sutton) expressed, on behalf of the Corporation, their regret that this terrible accident had happened. He did not think any reflection could be made upon the management; and he thought the accident was the result of a misapprehension, and a very slight one, of the duties to be performed by the men.

The Coroner having summed up, the Jury returned a verdict to the effect that Edward Howarth died from burns accidentally received from a gas explosion which occurred at the Coventry Gas-Works on the 8th of July, and although they could not fix the blame on any individual, they were unanimously of opinion that "there had been great laxity of discipline in the management all round." They deeply sympathized with the widow and family.

The inquiry then closed.

BURRY PORT GAS BILL.

Its Withdrawal and Its Cost.

Some days ago, a meeting of the ratepayers of the Burry Port urban district was held for the purpose of receiving the report of the Council upon the Burry Port Gas and Improvement Bill. The duty of preparing this document the Council delegated to Mr. William Howell, their Clerk; and thus it was left for him to explain how it came about that from £500 to £600 was spent on a Bill which was subsequently withdrawn.

The report submitted by the Clerk was a lengthy document; and in the course of it, he explained that the urban district of Burry Port is within the limits of supply of the Llanelly Gaslight Company, under the Llanelly Gas Act, 1874, section 5 of which includes the town of Llanelly and all lands in the county of Carmarthen situate within 5 miles from the entrance door of the Town Hall of Llanelly. It was originally desired to apply to the Local Government Board for a Provisional Order, under section 161 of the Public Health Act, 1875; but that section makes any application for a Provisional Order subject to the Gas and Water Works Facilities Act, 1870, section 3 of which provides that application may be made to construct gas-works in any district within which there is not an existing company empowered by Act of Parliament to construct works and to manufacture and supply gas. Although the Llanelly Company have had the power to supply Burry Port for 31 years, they never attempted, or, so far as is known, seriously considered, the undertaking of such supply; but inasmuch as they have the power, the Council were prohibited by section 3 of the Gas and Water Works Facilities Act, 1870, from applying for a Provisional Order, and their only alternative was to go for an Act. It was provided by the Llanelly Gas Act, 1874, that the price at which gas should be sold within the parliamentary borough of Llanelly should not exceed 5s. 6d. per 1000 cubic feet, and outside the borough 7s. The Urban Council felt that 7s. was a most ridiculous price; and as they failed to obtain any definite terms from the Company, they determined to promote a Bill to repeal the section of the Llanelly Gas Act, 1874, which gave the Company a statutory monopoly within their district, and to give the Council power to manufacture and supply gas. By clause 6 of the Council's Bill, it was proposed to enact as follows: "From and after the passing of this Act, all powers, rights, authorities, and privileges of, or belonging to, the Llanelly Gaslight Company under the provisions of the Llanelly Gas Act, 1874, for and relating to the supply of gas within the district, shall absolutely cease and determine." The Council proposed to repeal the power of the Company, inasmuch as the Company were not carrying on business within the district of the Council, and, further, had nothing to sell, beyond the abstract monopoly of supply. This Bill was passed so far as the first and second readings were concerned. Six petitions were lodged against the Bill, by the Great Western Railway Company, Mr. W. B. Roderick, the Earl of Ashburnham and others, the Llanelly Harbour Trust, Messrs. William Davies and others, and the Llanelly Gas Company. The most important was the Company's, one paragraph of which was as follows:

> "In this connection, your petitioners desire to inform your Honourable House that, although the maximum price for gas supplied by your petitioners within the district was fixed by the Act of 1874 at 7s. per 1000 cubic feet, your petitioners recognize that such a charge would at the present time be excessive; and your petitioners have informed the Council that they (your petitioners) are prepared, notwithstanding their statutory powers, to agree that the Act of 1874 shall be read as though the maximum price to be charged in the district for gas supplied by your petitioners were fixed at 4s. 6d. per 1000 cubic feet—that being the limit of price proposed to be charged by the Council by clause 13 of their Bill, and your petitioners are, and always have been, willing to supply the district with gas at the same prices as are charged for gas supplied to similar customers for like purposes in the parliamentary borough of Llanelly, with the addition of an extra charge in respect of the cost of laying down and maintaining the necessary main from Llanelly to Burry Port. Your petitioners were, and are, also willing to agree that the amount of such extra charge shall be determined by an engineer to be agreed upon between your petitioners

and the Council, and that in assessing such extra charge due allowance should be made in respect of the quantity of gas which it may be estimated would be supplied from the main to consumers along the line thereof at places outside the district.

Continuing his report, the Clerk said the Council were advised by both their Parliamentary Agents and their Parliamentary Counsel that there were ample precedents for their application to Parliament to repeal the existing monopoly—the Otley Improvement Act, 1905, and the Golbourne Gas Act, 1901, being cited as instances. Remarks made by the Lord Chairman of Committees of the House of Lords (one of which was that "he had a great mind to strike out the whole Bill") led the Council to reconsider their chances of success; and the opinion of Mr. Wedderburn, K.C., and Mr. W. L. Williams was sought. Asked whether there was a chance of success, these gentlemen replied: "Yes, assuming that the promoters can show (1) that they will be able to start their undertaking without any burden or excessive burden on rates; (2) that the laying of mains from Llanelly to Burry Port, and possibly the enlargement of the gas-works, would be a waste of money; (3) that the gas supplied to Llanelly has been bad; (4) that the Llanelly Gaslight Company's charges have been high, and are likely to continue so. The Golbourne Gas Act, 1901, is a precedent strongly in favour of the promoters here." In addition to this, the Clerk himself studied the Otley and Golbourne Acts; and the conclusion he came to was that these Acts formed no precedent, and that there would be a difficulty in proving the points Counsel advised were necessary.

The Clerk concluded his report by saying that the Council felt the Golbourne Act was no precedent for their Bill, and that, so far as they were advised, they were about to enter into a fierce conflict with a statutory monopoly, without precedent, in a tribunal where precedent was pretty nearly everything. The Gas Company then made a very fair offer; and it was possible that it would have been accepted, had it been made before the Council proceeded with their Bill. The offer was to supply gas on practically similar terms to those in existence at Llanelly. No doubt the offer was made with the view of strengthening their position in the House. In one of the Company's letters, the Council were given to understand that they would pay the whole of the Council's costs; but the Company went back on that, and said they were only prepared to pay £100. Having regard to the possible introduction of electric light, it was felt that they would probably get better terms from the South Wales Power Company; and as the Gas Company had receded from their original offer, they thought that the wisest thing they could do in the interest of the ratepayers was to withdraw the Bill.

After the reading of the report, a long discussion took place; the action of the Council meeting with a good deal of criticism. In reply to Mr. Hammond (who asked whether an endeavour had been made to obtain a supply of gas from the Llanelly Company before proceeding with the Bill), the Clerk explained that they began mooting this question in their meetings; and the discussions, of course, got reported in the newspapers, with the result that the Company, on April 11, 1905, wrote to the effect that the Directors had been informed that the Council contemplated lighting Burry Port with gas, and that they were prepared to undertake such lighting in accordance with the powers conferred upon them by their Act. In a subsequent letter, the Company inquired how many public lamps they would require, and the number of public buildings that would be lit by gas, together with the estimated consumption; also whether the Council had taken steps to find out what private consumers would take gas. The Council felt that the work of ascertaining the number of customers was a matter for the Gas Company, and not the Council. On Nov. 23, he wrote the Company intimating that the Council intended applying for powers to supply Burry Port with gas. During the whole period of the promotion of the Bill they were trying to come to an amicable arrangement with the Company. Mr. Hancock said they all agreed that the Council did the best thing in preventing any further expense by withdrawing the Bill. The question was, Why did they promote it at all? Mr. Willis pointed out that they had brought the Company "to a sense of their duty," and had secured a reduction of the maximum charge for gas. Mr. Hammond said he would have liked to have seen an arrangement with the Gas Company embodied in the Bill, which could then have been passed. As it was, they had nothing to show for their £500 or £600. It was monstrous to attempt to repeal an Act of Parliament when no negotiations had been entered into with the view of getting a supply of gas from the Company who had statutory powers, before proceeding with the Bill. Mr. Brown (a member of the Council) said that he had forgotten to read a letter which had been written by the Gas Company to the Surveyor on Aug. 1 last. The letter stated that it was the intention of the Company to extend and lay their gas-mains from Llanelly to Burry Port. A contract had been entered into for the work, and would be carried out shortly. This letter had nothing whatever to do with the Council as regarded the contract. The Clerk: So that the money spent has not been for nothing after all.

A resolution approving of the action of the Council in withdrawing the Bill was unanimously passed.

Gas-Main on Fire.—A great gas-flame burnt for several hours last Friday morning in Knollys Road, Streatham. A leakage had occurred in the main, and while the workmen were looking for it the gas became ignited. The flame was so fierce that the fences round the gardens of the adjoining houses caught fire, and though the Fire Brigade arrived, nothing could be done until the gas was turned off.

Ottoman Gas Company, Limited.—At the ordinary general meeting of this Company on the 11th inst., the Directors will report that the gas-rental for the half year ending the 30th of June amounted to £13,260, while for the corresponding half of 1905 it was £11,875. The net profit is £2991; whereas for the corresponding six months it was £2836. The amount standing at the credit of the profit and loss account is £7445; and the Directors recommend the payment of a dividend at the rate of 7 per cent. per annum on the preference shares, less income-tax, and at the rate of 7 per cent. per annum on the ordinary shares, tax free, leaving a balance of £4846 to be carried forward.

GAS AND ELECTRICITY AT MALTON.

Ever since the advent of the Northern Counties Electricity Company into Malton, there has been keen competition between them and the Gas Company. The Electricity Company secured the tender for the lighting of Malton; but the Gas Company obtained the tender for the lighting of Norton. The question of the lighting of the Malton Workhouse came up recently; and the Guardians solicited tenders for this purpose. The Gas Company offered to do it at the rate of 2s. 6d. per 1000 cubic feet, and give free attendance to burners, &c.; while the Electric Light Company proposed to put in at their own expense the installation required to enable them to light the building, provided the Guardians were willing to enter into a contract for ten years. Their tender for lighting was £40 per annum; and they undertook to do the lighting and provide all new lamps as required for £45.

At a Committee meeting held during the past week, it was decided, on the Chairman's casting-vote, to accept the tender of the Electricity Company. News of this leaked out; and the Gas Company issued a circular-letter to each Guardian, pointing out alleged discrepancies. The Gas Company complained of the vagueness of the advertisement soliciting tenders, and pointed out that it distinctly stated "for one or three years." They also complained of the submission to the Committee of inaccurate figures, and of the Committee negotiating with one of the parties tendering for a contract on terms entirely different to the advertisement. The effect of this circular was that the previous decision arrived at was upset; and it was resolved that the matter stand over for another twelve months.

Mr. Plowman, at Saturday's meeting of the Board of Guardians, when the minutes of the Committee came up for adoption, complained bitterly of the Committee's action being upset. He said the Committee were composed of practical men, and men who attended meeting after meeting; and he objected to all the rest of the Guardians being advised by the Gas Company to upset the arrangement. Colonel Legard moved that the matter stand over for a year. He referred to the fact that it had been estimated that in adopting electricity they would effect a saving of £11. This might be; but he pointed out that, of the 132 lights in the workhouse, only 42 were incandescent burners, and all would agree that incandescent lights were better, and consumed less gas, than the old burners. Therefore it was reasonable to suppose they could curtail their expenditure. The minutes were passed and the matter then dropped.

MANAGEMENT OF THE ABERGAVENNY GAS-WORKS.

Complaints of Increased Cost.

For the past few months various rumours have been in circulation at Abergavenny relative to the way in which the gas-works are being managed. When the matter came to the knowledge of the Town Council, the Gas Committee were at once instructed to present a report; and it was submitted to the Council at their meeting on Monday of last week, when the Mayor (Mr. J. C. Gwatkin) presided. The report of the ordinary meeting of the Gas Committee was first presented. In it appeared a statement to the effect that a large bill for cooking-stoves ordered by the Manager (Mr. Hubert Russell) in excess of the amount of the loans authorized, and another for cannel coal, likewise ordered by him, were directed to be held over. On a resolution being moved to adopt the report, Mr. Wheatley called attention to the purchase of the stoves, and reminded the Council that some months ago it was resolved that nothing should be ordered without the sanction of the Gas Committee. Perhaps the Chairman of the Committee could explain the matter. Mr. S. Deverall (the Chairman) said he would do so when the minutes of the special meetings of the Committee were before the Council. He subsequently brought these up and moved their adoption. After some conversation, it was decided by seven votes to five to supply them to representatives of the Press.

The minutes showed that on the 16th of August the Committee examined a statement of the gas accounts for the year ending the 31st of March last, showing a loss of £488 10s. 1d.; and they ordered that a copy of the same be sent to the Gas Manager with instructions to furnish an explanation of the loss. This was supplied on the 21st; and in the course of the Committee's report on the matter, they said: "The Committee do not accept this explanation as satisfactory, and they recommend that the Council employ a chartered accountant to investigate the gas accounts for the year 1905-6, owing to the unsatisfactory condition of the present accounts, and to place them on a proper basis for better working; also that a gas expert's opinion on the gas-works be deferred until the accountant has reported on the coal consumption. The Committee also suggest that the Council take into consideration the administration of the gas-works by the present Manager. The Committee have given directions to the Gas Manager not to order anything whatever without the authority of the Committee." Accompanying the report was a statement by Mr. Russell, in which he indicated the items on which the expenditure had been more than that of the preceding year. He admitted that the coals purchased from the North had not come up to his expectations; but, in order to show that the expenditure was being kept down, he pointed out that for the four months April to July last the accounts showed a saving of nearly £500 on the corresponding period of last year.

In the course of the remarks to which the presentation of the reports gave rise, Alderman Gwatkin said he was astounded when he opened his report and saw there was a deficit of £488. When the former Manager (Mr. Cross) was in charge of the works, the Council were receiving a handsome revenue; but they had gone in for a large scheme from which they were promised a reduction of 8d. in the pound in the rates, whereas they would have an increase of 6d. Mr. T. A. Delafield expressed the opinion that when the accounts were examined it would be found that the difference between those of the Town Clerk and Mr. Russell would be considerably decreased. The gas accounts had not

been kept in an up-to-date and businesslike manner for the last ten years. Some discussion took place as to obtaining the services of an accountant; and the matter was eventually referred to the Gas Committee, with power to act. Alderman Gwatkin then moved that, in view of the Committee's dissatisfaction with the Manager's explanation, he should be paid a month's salary and be relieved of his duties. Mr. Straker remarked that if the Council agreed to this proposition they would be taking a leap in the dark. Mr. Deverall suggested that the motion should be withdrawn, so that for the present the questions before them could be discussed without heat or feeling. He then went on to refer to matters which had been dealt with by the Committee, and said that when Mr. Cross was Manager things went on very well; but with the new management and the new plant they unfortunately had a fresh state of things. However, personally, he would not condemn anyone until the whole question had been threshed out. With regard to the expenditure on stoves, the difficulty arose as to where they were to get the money for them, as they had exhausted their loans, and had no capital to pay for the investment. After some further remarks, it was decided to defer the matter for a month.

GAS SUPPLY OF FRANKFORT-ON-THE-MAIN.

It is announced in the report of the Frankfurter Gas Gesellschaft for 1905-6, to which reference will subsequently be made, that the Company have given notice to terminate, on May 31, 1911, the lighting agreement which was concluded with the municipal authorities in June, 1885. In commenting on this intimation, the "Frankfurter Zeitung" states that it was to be assumed that something special was in progress when a few years ago the Imperial Continental Gas Association and the Frankfort Gas Company made arrangements in regard to a community of working, and when the Association were represented on the Board of the Company. This assumption has been confirmed by the notice that the Company have exercised their right to determine the agreement of 1885, which is based on the specification dated May 1, 1871. The notice is founded upon the complaint that restrictive limits are at present being set to the development of the undertaking, not so much owing to the conditions of the concession, which extends to 1959, as to the existing agreements with the municipal authorities within the concession period to 1911. The limitation is also connected with the question of competition in the supply of gas. So far as the latter is concerned, the above-named paper remarks that, having regard to the friendly relations prevailing between both the private gas undertakings, the reference can only be to municipal gas-works—that is to say, to the Heddernheim works, which supply some neighbouring communes, and the projected Niederrad works.

The agreement of June 26, 1885, provides (section 19) that in case the Gas Company do not declare, five years before the expiration of this concession, that they do not wish it to be prolonged beyond the fixed period, the municipal authorities have the right to extend it on the same conditions for the following 25 years, or for a shorter term (at least five years), if they so declare at the latest one year before the expiration of the concession. Section 20 specifies that on the lapse of the concession granted to the Company for 99 years, it reverts fully to the town without the special conditions coming into operation. This concession, which was granted by the Free City of Frankfort, runs to Sept. 30, 1959. The concession expiring in 1911 places upon the town the obligation until that time not to establish their own gas-works for working as a business, or to be carried on for their own account, though this may be permitted to third parties.

The notice to terminate the agreement, the writer in the Frankfort paper remarks, does not come to the municipal authorities unprepared. It was not to be assumed that they would renew the existing agreement. Unfortunately, the most suitable time—between 1868 and 1870—for erecting municipal gas-works was neglected. The leaders in a strong agitation succeeded in proving the remunerativeness of such works; and the municipal authorities for a long time showed a great inclination to carry the scheme into effect. At the last moment, however, they declined to do so, and entered into a new agreement which was to expire in 1886, but which was prolonged in 1885 to 1911 on materially improved conditions.

The report for 1905-6 of the Frankfort Gas Company refers to the notice to terminate the lighting agreement, which it states has been brought about by the restriction of the undertaking arising from its conditions, and has been accentuated by competition in the supply of gas. The net profits, which declined from £19,913 in 1903-4 to £19,449 in 1904-5, rose to £23,359 in the past year; while the total sales of gas augmented by 1·39 per cent. The increase in the sale of gas for lighting purposes mainly concerned the public illumination of the streets and government and municipal buildings; but the consumption by private users again showed a slight decline, though once more there was a material advance in the sales for cooking and heating purposes and to the prepayment meter consumers.

It was possible for the Company to purchase Australian shale at the previous year's prices; but freights to Rotterdam were higher. First-class Scotch cannel coal of an approved kind was dearer, while only inconsiderable purchases of German cannel were made at former prices, as cannel is merely raised in small quantities in Westphalia. Gas coal from the Saar district was procured on the basis of former quotations. In the case of bye-products, the report states that coke and tar were sold at about the same rates as in 1904-5; and that sulphate of ammonia also yielded higher profits. The sale of gas burners and fittings, cooking and heating appliances, &c., was not less than in the preceding year; but the profits were not quite equal, owing to the reduction of prices.

The maintenance of the installations, on the other hand, necessitated an increased expenditure, especially on buildings, gasholders, mains, &c. Taxes, bank commission, salaries, and wages (especially the last), again advanced; but less expense was incurred for water, glycerine, and various other things, and also for local rents. The larger payments to the town were based upon the increased sales of gas. After placing £12,250 to the second special reserve and other funds, and making other appropriations, the balance of profits allowed of the payment of a 10 per cent. dividend on the share capital of £90,000; being the same rate as was paid in 1904-5.

Reduction in Price at Blyth.—At the half-yearly meeting of the Blyth and Cowpen Gas Company, it was agreed that, as from the meter-readings in December next, the price of gas should be further reduced from 3s. to 2s. 10d. per 1000 cubic feet. The usual discount will still apply.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 630.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	21—22	..	4 15 5
160,000	10	,,	7½	Do. 7 p.c.	14⅜—15⅛	..	4 16 9
200,000	5	May 11	7	Bomb'y, Ltd.. . . .	6¾—7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	5—5⅛	..	5 1 10
50,000	10	Aug. 30	14	Bourne-) 10 p.c. . .	28—29*	−⅛	4 18 9
51,810	10	,,	7	mouth Gas) B 7 p.c. .	16⅝—17¼*	−⅛	4 1 3
53,200	10	,,	6	and Water) Pref. 6 p.c.	15⅛—16⅜*	..	3 12 9
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	260—265	..	4 14 4
300,000	,,	,,	9½	Do. New . . .	198—203	..	4 13 7
50,000	,,	,,	5	Do. 5 p.c. Pref. .	120—125	..	4 0 0
706,250	,,	June 14	4	Do. 4 p.c. Deb. .	103—106	..	3 15 6
220,000	Stk.	Mch. 9	11¼	Brighton & Hove Orig.	234—239	..	4 14 2
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	167—172	..	4 15 11
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c. .	119—123	..	4 17 7
165,760	,,	,,	4½	Do. do. 3½ p.c. .	90—93*	..	4 16 9
500,000	10	May 11	7	Buenos Ayres (New) Ltd.	12⅛—12¾	..	5 9 10
250,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
150,000	20	July 12	8¼	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	June 14	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	9¾—10¼	..	4 7 10
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	June 28	4½	Do. 4½ p.c. Deb. Stk.	98—100	..	4 10 0
1,443,280	Stk.	Aug. 30	5⅛	Commercial 4 p.c Stk. .	112—115*	−2½	4 10 5
560,000	,,	,,	5	Do. 3½ p.c. do. .	110—112*	−2	4 9 3
475,000	,,	June 14	3	Do. 3 p.c. Deb. Stk.	84—86	..	3 9 9
800,000	Stk.	,,	6⅔	Continental Union, Ltd.	123—126	..	5 3 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	140—145	..	4 16 7
432,070	Stk.	Aug.	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	July	4	Do. Deb. Stk. . . .	105—107	..	3 14 9
486,090	10	July 27	11	European, Ltd. . . .	24—25	..	4 8 0
354,060	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 10
15,203,110	Stk.	Aug. 15	4⅘	Gas-) 4 p.c. Ord. . .	99—100	+½	4 8 0
2,600,000	,,	,,	3½	light) 3½ p.c. max. . .	87—89	..	3 18 8
3,799,735	,,	,,	4	and) 4 p.c. Con. Pref.	108—111	+1	3 12 1
4,193,975	,,	June 14	3	Coke) 3 p.c. Con. Deb.	86—88	..	3 8 2
258,740	Stk.	Mch. 9	5	Hastings & St. L. 3½ p.c.	100—105	..	4 15 3
82,500	,,	,,	6½	Do. do. 5 p.c.	121—124	..	5 4 10
70,000	10	Apl. 11	11	Hongkong & China, Ltd.	20—21	..	5 4 9
940,000	Stk.	May 11	8	Imperial Continental .	185—188	+2	4 5 1
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	95—97	..	3 12 2
183,242	Stk.	Aug. 30	6	Lea Bridge Ord. 5 p.c. .	120—125*	−2	4 16 0
561,000	Stk.	Aug. 30	10	Liverpool United A . ,	230—232*	−5	4 6 2
718,100	,,	,,	7	Do. B .	168½—170½*	−3½	4 2 1
306,083	,,	June 28	4	L'rpool Unit'd Deb. Stk.	107—109	..	3 13 5
75,000	5	June 28	5	Malta & Medn., Ltd. .	4¼—4⅜	..	5 5 3
560,000	100	Apl. 2	5	Met. of) 5 p.c. Deb..	103—105	..	4 15 3
250,000	100	,,	4½	Melbourne) 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd. . .	11—12	..	5 16 8
1,675,892	Stk.	Aug. 15	4½	Newc'tle & G'tesh'd Con.	110—112	..	4 2 7
406,025	Stk.	June 29	3½	Do. 3½ p.c. Deb.	97—100	+1	3 10 0
15,000	10	Aug. 30	10	North Middlesex 10 p.c.	20—21*	..	4 15 3
55,940	10	,,	7	Do. 7 p.c.	13¾—14¼*	..	4 16 7
300,000	Stk.	May 11	8	Oriental, Ltd. . . .	150—153	..	5 4 7
60,000	5	Mch. 28	7	Ottoman, Ltd. . . .	6—6¼	..	5 7 8
398,490	5	Apl. 26	7	Primitiva Ord. . . .	6¾—7⅛	..	4 16 7
796,980	5	July 27	5	Do. 5 p.c. Pref. .	5⅞—5⅞	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
851,070	10	Apl. 26	7	River Plate Ord. . . .	12⅝—13	..	5 7 8
300,000	Stk.	June 28	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
250,000	10	Mch. 28	8	San Paulo, Ltd. . . .	14¼—14⅜	..	5 5 8
70,000	50	July 2	5	Do. 5 p.c. Deb. .	49—51	..	4 18 0
135,000	Stk.	Mch. 28	10	Sheffield A	244—246	..	4 1 4
209,984	,,	,,	10	Do. B	244—246	+1	4 1 4
523,500	,,	,,	10	Do. C	244—246	+1	4 1 4
70,000	10	May 31	10	South African	16—17	..	5 17 8
6,350,000	Stk.	Aug. 15	5⅛	South Met., 4 p.c. Ord.	131—133	..	4 2 8
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	86—88	..	3 8 2
575,000	Stk.	Aug. 15	5⅛	S'th Suburb'n Ord. 5 p.c.	122—125	..	4 8 0
60,000	,,	,,	5	Do. 5 p.c. Pref. .	123—126	..	3 19 4
112,533	,,	July 12	5	Do. 5 p.c. Deb. Stk.	128—133	..	3 15 2
502,310	Stk.	May 11	5	Southampton Ord. . .	107—112	..	4 9 3
120,000	Stk.	Aug. 30	6⅔†	Tottenham) A 5 p.c. .	125—130*	−2	5 0 0
388,020	,,	,,	5†	and) B 3½ p.c. .	100—103*	−2	4 17 1
137,500	,,	June 28	4	Edmonton) 4 p.c. Deb.	103—105	..	3 16 2
182,380	10	June 14	8	Tuscan, Ltd.	10¼—10⅜	..	7 8 10
149,960	10	July 2	5	Do. 5 p.c. Deb. Red.	100—103	..	4 17 1
30,000	Stk.	Aug. 15	8	Wands-) A 5 p.c. . .	—	..	—
255,636	,,	,,	6⅔	worth) B 3½ p.c. . .	135—140	..	4 12 10
75,000	,,	,,	5⅓	and) C 3½ p.c. . .	110—113	..	4 19 1
79,416	,,	June 28	3	Putney) 3 p.c. Deb. Stk.	82—85	..	3 10 7
279,875	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord. .	105—107	..	4 15 9
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
193,300	,,	June 28	4	Do. 4 p.c. Deb. Stk.	104—107	..	3 14 9

Prices marked * are "Ex div." † Next dividend will be at this rate.

COVENTRY GAS AND WATER WORKS.

At last week's Meeting of the Coventry City Council, the Water-Works Committee recommended that the City Engineer (Mr. J. E. Swindlehurst) be appointed Water Engineer, at a salary of £100 per annum in respect of additional duties; that Mr. E. J. Purnell be retained as Consulting Water Engineer, at his present salary of £200 per annum; and that a Chief Water Inspector be appointed, at a salary of £200. Mr. Snape, in moving that the recommendations be referred back, said he favoured the appointment of a responsible Manager at the head of the undertaking. One of the Labour members—Mr. Poole—remarked that the recommendation with regard to Mr. Purnell emphasized the necessity for a superannuation scheme for Corporation officials. On a vote being taken, the recommendations were referred back by 27 to 9.

The annual accounts of the Corporation were submitted by Mr. Bettman, who said they were an excellent compilation, and showed that the various undertakings were admirably and soundly managed, and that there was no over-indebtedness, as they so often heard. They also gave indisputable proof of the prosperous development of Coventry. The rateable value of the city had increased by over 50 per cent. in ten years, or, roughly, from £200,000, to £311,000. The gas consumption had increased 150 per cent.; but in the same period the water supply had been increased by only 26 per cent. In his opinion, the Water-Works Committee had not kept pace with the development of the city. Proportionately, Coventry consumed more gas than any town in the kingdom. The accounts were approved.

In reply to a question, Alderman Bird stated that the Water-Works Committee had now stopped taking an auxiliary supply from the North Warwickshire Water Company. The city supply was now ample.

Southampton Gas Company's Assessment.—A conference is to be held between the Directors of the Southampton Gas Company and the Board of Guardians, with regard to the assessment of the Company's undertaking. The Guardians had informed the Company that their Valuer had increased the rateable value of their property by £3172; and the Company's Solicitors, in reply, pointed out that this proposed increase would involve an extra expenditure by the Company in Southampton rates of about £1500 per annum, thus increasing their contribution to local rates to the sum of £5650. They also added that the proposed increase in the Company's rateable value might involve a rise in the price of gas. They suggested that, in the hope of arriving at an amicable settlement of the question, and in order to avoid if possible the enormous cost to both sides of an appeal to Quarter Sessions, there should be a conference between the Guardians and the Directors; and this the Guardians agreed to.

LEEDS CORPORATION WATER-WORKS.

Colsterdale Reservoir to be Abandoned.

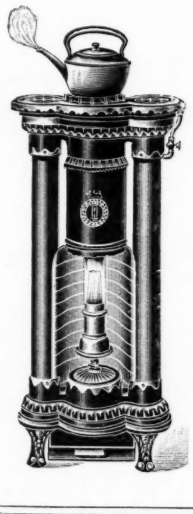
It was officially announced by the Water Committee of the Leeds Corporation on Tuesday that, subject to the approval of the City Council, the construction of the Colsterdale reservoir, in the Ure Valley, would not be proceeded with. For some time past, Mr. Henry Rofe, M.Inst.C.E., has been making investigations on the proposed site of the reservoir, and the Water Committee made a special journey to Colsterdale on Monday last week to receive a joint report, drawn up by Mr. Rofe and the Water Engineer to the Corporation (Mr. C. G. Henzell, M.Inst.C.E.). The report was fully considered, and as a result the following resolutions were passed by the Committee:—

1.—That the Council be advised to adopt the recommendations of the Water-Works Engineer and Mr. Rofe, contained in their joint report, and, in accordance therewith, authorize the Parliamentary Committee to make application to Parliament for the following powers: (*a*) To abandon the construction of the Colsterdale reservoir, authorized by the Leeds Corporation Water-Works Act, 1901; (*b*) to construct a reservoir by means of an embankment or dam across the River Burn; (*c*) to extend the aqueduct No. 1 authorized by the Act of 1901 from the point of commencement to the new Colsterdale reservoir; (*d*) to extend the catchwater No. 1 from the point of commencement authorized by the Act to Spruce Gill; (*e*) to lay a conduit or line of pipes commencing in the new Colsterdale reservoir and terminating at Spruce Gill; (*f*) to enable the Corporation to take a supply of water from the River Burn and the River Laver during the construction of the reservoir; (*g*) to extend the time for the completion of the works authorized by the Act of 1901; (*h*) to obtain the necessary powers ancillary to, or in connection with, the works above set out, including power to acquire land compulsorily.

2.—That the Council be also recommended to proceed forthwith with the construction of the Leighton reservoir, in accordance with the recommendation of the joint report.

The decision of the Committee may be regarded as the sequel to the extraordinary disclosures in reference to the site of the reservoir which were made by the Chairman (Mr. J. H. Armitage) to the City Council last October, and fully noticed in the "JOURNAL" at the time.

It may be of interest, in connection with the important action taken by the Committee, to give a few particulars in regard to the undertaking which has met with so serious a check. It was in 1901 that the Leeds Corporation obtained parliamentary powers to proceed with their scheme of obtaining a water supply from the Ure Valley. As then approved by Parliament, the scheme was to be an enormous one, involving an outlay of more than £2,000,000. Four reservoirs were to be built—the Colsterdale, which it is now proposed to abandon; the Leighton, which is to be proceeded with forthwith, both situated in the Burn Valley; and the Carlesmoor and the Laverton, which will be in the Laver Valley. The Colsterdale was to be the biggest of the four, covering an area of 107 acres, and having a holding capacity of 1852 million gallons. The daily yield was anticipated at 7,296,000



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gallons for Leeds, and 3,648,000 gallons for compensation water. The ground which was then approved as the site was on the edge of the moors; and it was to have a supply from a watershed of 8327 acres. Few serious engineering difficulties were anticipated, and tenders for the work were advertised for. There was a fierce contest as to whether the work should be done by contract or under the control of the Corporation; and eventually the contract for the reservoir was let in April last year to Messrs. R. M'Alpine and Sons, of Glasgow, whose tender amounted to £296,863. On the day the contract was let, Mr. Henzell was appointed Water-Works Engineer for the city, and he at once commenced an investigation into the plans for the reservoir. For a time nothing further was heard; but it was evident that something serious had been discovered, as the work at the site remained practically at a standstill.

In October came the revelations of Mr. Armitage, who had recently been appointed Chairman of the Water Committee. He stated that from the 29 large contract drawings he had a list of more than 300 mistakes—225 of which were most serious, involving a probable loss to the Corporation of thousands of pounds. The result of his investigations was that they had one of the most shocking and unfortunate exposures that they had ever had in connection with the planning of any work for any city in the country. Mr. Armitage's remarks naturally created a great sensation in the city, and at the next Council meeting, acting on legal advice, the contract was rescinded. It had become evident, Mr. Armitage then announced, that the essential features of the contract would have to be altered, and that it would be necessary to prepare an entirely new specification when the Engineer was in a position to advise as to the site and the nature of the work required in connection with the erection of the bank.

From that time onwards, Mr. Henzell and Mr. Rofe have been making their investigations. Trial holes have been repeatedly bored; and now, as a result of the Engineers' investigations, the Committee recommend that the site of the reservoir shall be transferred to the other side of the Burn.

The Leighton reservoir, which it is proposed should be proceeded with at once, is three-quarters of a mile from Colsterdale. According to the plans which were approved by Parliament, the superficial area of water is to be 105 acres, and the height of the embankments 110 feet. The holding capacity is to be 1136 million gallons, and the drainage area 2480 acres. The quantity of water available for Leeds will be 2,173,000 gallons daily; while the amount of compensation water is to be 1,086,000 gallons daily.

It was estimated that 100,000 tons of material would be required for the Colsterdale and Leighton reservoirs, which were to have been completed by 1911. It is now proposed, as already mentioned, to apply for an extension of time. The total capacity of the four reservoirs was to be 4543 million gallons, with a daily yield of 15½ million gallons.

Among the works to be immediately undertaken by the City Council of Auckland, New Zealand, are water-works, which are estimated to cost £150,000.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Gas and Electricity accounts of the Corporation of Aberdeen for the year ending July 31 were submitted to the Gas and Electric Lighting Committee yesterday, and were approved of and sent forward to the Council for consideration. In the Gas Department, the revenue amounted to £112,623, as compared with £112,434 in the previous year. Of this sum, there was derived from the sale of gas £90,164, as compared with £89,877; residual products realized £20,467, as compared with £20,110; house services produced £1328, as compared with £1778; and gas-stoves £553, as compared with £541. The total expenditure amounted to £92,037, as compared with £92,698. Coal cost £51,376, as compared with £52,473; purifying materials (less £214 for waste lime and spent oxide sold), £1657; salaries and wages were £14,255; maintenance of works cost £1219; and maintenance of plant £4848—making the total charge for the manufacture of gas £73,746, as compared with £74,388. The distribution of gas, including wages of meter inspectors, cost £1426; the repairing and fixing of meters, £1096; and the repair and maintenance of mains and service-pipes, including laying, paving, and labour, cost £3718, as compared with £3863. House services cost £1140, as compared with £1546; gas-stoves yielded £553 (which has been written off for depreciation), as compared with £541; rents, rates, and taxes, amounted to £6486, as compared with £6159; management cost £1891, as compared with £1914; general charges amounted to £780, as compared with £713; and bad debts amounted to £3719, as compared with £3557. There was a net profit for the year of £20,585, as compared with £19,736 in the previous twelve months, and £23,770 in the preceding year. The capital expenditure for the year was £13,444, which raises this account to £347,647. In the disposal of the profit, £3971 was applied in the payment of annuities, £4149 for interest and contribution to the reserve fund, £9397 was placed to the sinking fund for the redemption of mortgages, and £650 to the sinking fund for the redemption of annuities, and the reserve and fire-insurance fund amounted to £300. There remained a balance of £2118 on the year's working, and this sum, added to £7858 brought forward from the preceding year, makes a total of £9976 to be carried to the current year's account. During the year there were carbonized 68,414 tons of coal, from which there was a yield of 691,306,000 cubic feet of gas, being equal to 10,105 cubic feet per ton of coal. In the previous year, the make of gas was 666,330,000 cubic feet; so that the gas produced increased by 24,976,000 cubic feet. There was accounted for 656,171,000 cubic feet—unaccounted-for gas amounting to 35,135,000 cubic feet, equal to 5·08 per cent, as compared with 4·67 per cent. the previous year. The Committee have estimated for an output of 670 million cubic feet of gas in the current year, from which they expect a revenue of £87,496. From residual products, and other sources, they estimate an income of £20,926; making a total revenue

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of £108,422. They propose to set aside £4000 to a renewal fund, and estimate a total expenditure of £115,874, or £7452 above the revenue, which will enable them to get rid of the surplus which they have been obliged to carry forward. They have agreed to recommend that the price of gas be reduced to ordinary consumers from 2s. 9d. to 2s. 7d. per 1000 cubic feet, for power purposes from 2s. 6d. to 2s. 4d., and to give 26 cubic feet of gas for a penny to prepayment meter consumers, instead of 23 cubic feet as hitherto; the reduction to prepayment consumers being equal to 5d. per 1000 cubic feet.

In the Electricity Department, the revenue was £41,656, as compared with £39,047; and the expenditure amounted to £17,016, as compared with £17,037. There was an available balance of £24,639, as compared with £22,009. The payments out of the balance were: £7780 for interest, £7572 for depreciation, and £5448 to sinking fund; leaving a surplus of £3839. The amount expended upon the electricity works has been £276,916, of which £39,454 has been written off as depreciation. The Committee have agreed to recommend that the price of current be reduced to ordinary consumers from 6d. to 5½d. per unit; for public lighting for the first hour from 6d. to 5½d., the price for subsequent hours to remain at 1½d. per unit; and for motor and heating purposes from 3d. to 2½d. per unit for the first hour of demand, the subsequent demand being at 1d., as at present.

With regard to the supply of gas-fittings to the trade by the Perth Corporation Gas Department, Mr. M'Donald, the Inspector of Lighting, complains that he is charged by the Gas Department, for burners and mantles required for public lighting, from 2s. to 6s. per gross more than by any of the private traders in the city. The subject was discussed on Thursday by the Committee of the Town Council who have charge of the public lighting; and the Committee heard what Mr. M'Donald and Mr. W. B. M'Lusky, the Gas Engineer and Manager, had to say upon it. A discussion followed, in the course of which Bailie Young, the Convener, it is reported, intimated that he finds it necessary to resign his convenership. To-day it is announced that Lord Provost Cuthbert, who is Convener of the Gas Committee, has also resolved to retire from the Council, presumably in November, on account of the same incident.

The railway to the new Corporation Gas-Works at Falkirk, about which there was so much negotiation, has now been completed, and was brought into use last week.

The Cowdenbeath Gas Company have reduced the price of gas from 4s. 2d. to 3s. 11½d. per 1000 cubic feet, and they have likewise raised the rebate to prepayment-meter consumers from 1s. 8d. to 2s. 6d. in the pound.

In the course of the summer, the Coatbridge Gas Company arranged with the Corporation for the supply of gas for public lighting, on liberal terms. Thereafter they had their half-yearly meeting, at which reductions in the prices of gas were resolved upon. Following upon this, the Secretary of the Company wrote to the Town Clerk, stating that the Directors had agreed to reduce the price of gas for public lighting in proportion.

CURRENT SALES OF GAS PRODUCTS.

Week ending Sept. 1.

On the London market the position of pitch is well maintained. A large quantity has been sold for shipment September-December at 30s. 6d. net at makers' works; but this figure would not be repeated—31s. 6d. to 32s. being now asked for this year and more for next year. It is stated that 46 frs. is the present quotation for pitch on waggon at Antwerp for September-December delivery. Higher prices are clearly anticipated, as many Continental consumers are anxious to buy for forward shipment. Benzol 90 per cent. is in request; 10¼d. net having been paid for prompt, while 10½d. is now asked. Ordinary London creosote has been done at 2¼d. net per gallon. Sulphate of ammonia remains without change.

Sulphate of Ammonia. LIVERPOOL, *Sept.* 1.

The demand has been well sustained in Scotland, where towards the close of the month requirements have been large. There has also been a fair demand at other points; but supplies are becoming more plentiful, and prices have only been maintained. The closing quotations remain at £11 17s. 6d. per ton f.o.b. Hull, and £12 per ton f.o.b. Liverpool and Leith. In the forward position, there has again been good inquiry; but the firmness of makers hinders business. For October-December delivery £12 5s. per ton is now quoted, and for October-March £12 7s. 6d. per ton. For January-April, £12 7s. 6d. per ton has been paid, and £12 10s. is now asked for this position and for January-June delivery.

Nitrate of Soda.

This is very firm in all positions, and spot prices are 11s. 4½d. and 11s. 10½d. per cwt. for ordinary and refined qualities respectively.

Tar Products. LONDON, *Sept.* 1.

The market during the past week has been firm all round, without, however, much alteration in prices; and there does not appear to have been very much business doing. Manufacturers' ideas for pitch are very firm indeed; but up to the present dealers do not seem willing to pay the prices asked. The principal London Companies still quote 31s. 6d. to 32s.; but they have certainly not done business at these prices for any quantity. On the east coast, manufacturers are holding for 30s.; while on the west coast, where the market seems to be particularly firm, they do not appear willing to entertain anything under 30s. Liverpool and 29s. Manchester. There still seems to be practically no demand from the Continent, and consumers are

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	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
Blackburn	1,250,000	Winnipeg, Man.	500,000	Malton	150,000
Windsor St. Works, Birmingham	2,000,000	Colchester (Second Contract)	300,000	Smethwick	500,000
Saltley Works, Birmingham	2,000,000	York	750,000	Gravesend	300,000
Colchester	300,000	Rochester	500,000	Pernambuco, Brazil	125,000
Birkenhead	2,250,000	Kingston, Ont.	300,000	Duluth, (Second Contract)	300,000
Devizes	120,000	Crystal Palace District	2,000,000	Leicester (Second Contract)	1,000,000
Saltley, Birmingham (Second Contract)	2,000,000	Duluth, Minn.	300,000	Newport (Second Contract)	250,000
Windsor St., Birmingham (Second Contract)	2,000,000	Caterham	150,000	Brockville	250,000
Halifax	1,000,000	Leicester	2,000,000	Toronto (Third Contract)	750,000
Toronto	250,000	Enschede, Holland	150,000	Montreal, Ont. (Second Con.)	1,800,000
Ottawa	250,000	Buenos Ayres (River Plate Co.)	700,000	Toronto (Fourth Contract)	1,000,000
Lindsay (Remodelled)	125,000	Burnley	1,500,000	Hamilton, Ont.	400,000
Montreal	500,000	Kingston-on-Thames	1,750,000	Rochester (Third Contract)	1,600,000
Toronto (2nd Cont., Remodelled)	2,000,000	Accrington	500,000	Leeds (Second Contract)	900,000
Belleville	250,000	Tonbridge	300,000	Buenos Ayres (Primitiva Co.)	1,200,000
Ottawa (Second Contract)	250,000	Stretford	500,000	Buenos Ayres (New Co.)	1,200,000
Brantford (Remodelled)	200,000	Oldbury	300,000	Christchurch, N.Z.	300,000
St. Catherines (Remodelled)	250,000	Todmorden	500,000	Rochdale	1,600,000
Kingston, Pa.	125,000	Saltley, Birmingham (Third Contract)	2,000,000	St. John's, Newfoundland	250,000
Peterborough, Ont.	250,000	York (Second Contract)	750,000	Brantford (Second Contract)	400,000
Wilkesbarre, Pa.	750,000	Rochester (Second Contract)	500,000	Smethwick (Second Contract)	500,000
St. Catherines (Second Cont.)	250,000	Newport (Mon.)	250,000	Pontypridd	250,000
Buffalo, N.Y.	2,000,000	Tokio, Japan	1,000,000	Montreal (Third Contract)	1,800,000
		Newcastle-on-Tyne	1,800,000	Guelph, Ont.	350,000
		Leeds	1,800,000	Buenos Ayres (River Plate Co.) Second Contract	750,000
				Belgrano (River Plate Co.)	500,000

And, in addition, COAL GAS PLANTS at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

evidently anxious to obtain further contracts for briquettes before purchasing pitch. There is a very strong demand indeed for creosote. London manufacturers appear to be practically sold out to the end of the year, and in most cases quote 2¼d. for whatever quantity they may have to spare. Business, however, has been done at under 2d. for small quantities of second-hand oil, and 2d. is reported to have been paid for October delivery. In the North, business has been done at 1¾d. at distillers' works; but in most cases manufacturers ask 1⅞d. Up to the present, however, they have not been able to obtain this price. It it evident that in all quarters distillers are well sold, and are not anxious to entertain further business except at enhanced values. There is really no change in anthracene, and no sales are reported to have taken place during the past week. Solvent naphtha continues to be in very strong demand in London; and it is evident that manufacturers are in most cases behindhand with their deliveries. In the North, makers appear well sold for delivery to the end of the year; but they are inclined to accept existing prices for delivery all over next year, at which, however, business is at present impossible. In carbolic acid, Continental consumers still offer 1s. 9d. for 60's on the east coast; but no business is reported to have been done at this price. There has, however, been business in this quality for delivery up to the end of the year at 1s. 8¾d. at makers' works. There is no business reported in crystals, and there does not appear to be any demand for this article, except a small order for the French Government, which is certainly being very eagerly competed for. Business in toluol is again reported on the east coast at 1s. 1¾d. for delivery to the end of the year, and London manufacturers are firm in their ideas at 1s. 2d. for any small quantities which they may have to spare. Business is reported to have been done in the Midlands at 11d. into buyers' packages at makers' works. Benzol, 90 per cent., appears to be in fair demand. London manufacturers are reported to have sold at 9¾d. f.o.b., and are not now inclined to quote anything under 10d. per gallon; while in the North business has been done at 9¼d. to the end of the year. In the Midlands, some quantity was sold for delivery to the end of the year at 7¼d. into buyers' packages. For 50-90 per cent., the demand continues firm. Business has been done for delivery to the end of the year on the east coast at 11¼d.; while 11½d. has been realized in Manchester in more than one instance, and 10d. in buyers' packages delivered Manchester has also been accepted to the end of the year.

The average values during the week were: Tar, 15s. to 19s. [Owing to a clerical error, the price of tar was given last Tuesday as 15s. 9d. This should have been from 15s. to 19s., as before.] Pitch, London, 28s. to 28s. 6d.; east coast, 28s. to 28s. 6d.; west coast, 26s. 6d to 27s. 6d. Benzol, 90 per cent., 9½d. to 9¾d.; 50-90 per cent., 11¼d. to 11½d. Toluol, 1s. 1½d. to 1s. 2d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. 1d. to 1s. 2½d.; heavy naphtha, 1s. to 1s. 1d. Creosote, London, 1 15/16d. to 2d.; North, 1½d. to 1¾d. Heavy oils, 2¼d. Carbolic acid, 60 per cent., 1s. 9d. to 1s. 9¼d. Naphthalene, £4 10s. to £9 10s.; salts, 26s. 6d. to 28s. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

There has been practically no change in the market during the past week, and prices have remained steady, but with very little business doing. The principal London Gas Companies still maintain their quotation at £12 2s. 6d. Business is, however, reported to have been done in small quantities upon Beckton terms at £11 15s. to £11 17s. 6d.; while business has been done on London terms at £12. In Leith, makers are very firm in their ideas at £12 2s. 6d. for September; but second-hand parcels are reported to have been sold at £12. In Liverpool, business is said to have been done at £11 18s. 9d. and also at £12; while in Hull the market is from £11 17s. 6d. to £12.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The weather we are now experiencing does not benefit the coal trade. The inquiry is, however, normal. The reports of the principal Lancashire collieries for the past twelve months show very considerable profits; so that the coal trade generally may be taken as rather above the average. Quotations on the Manchester Coal Exchange show no variation from those published in last week's issue.

Northern Coal Trade.

Though the pressure and demand for coal is less than it was, a full production is still taken up, and prices have been maintained. Steam coals are a little easier, the best kinds perhaps excepted. Best Northumbrian steams are from 10s. 9d. to 11s. per ton f.o.b., second-class steams are 10s., and steam smalls from 6s. to 6s. 3d. Durham gas coals meet a larger home demand; the deliveries on the long contracts being increased, with the probability of a continued increase for four months or so. Prices range now from about 9s. 9d. to 11s. per ton f.o.b., according to quality; but much of the contract deliveries are at lower prices, fixed in the spring. As to contracts, tenders have been sent in for two small lots for Swedish and Italian works; but nothing is yet known as to the results, though it is believed that high quotations have been made. Coke is decidedly firmer; and this affects gas coke, though the increased production tells in the other direction. Export qualities of gas coke vary from 10s. 6d. to 11s. per ton f.o.b. Inland prices, however, vary more.

Scotch Coal Trade.

The market continues strong, but without any appreciable advance in quotations. The prices quoted are: Main 7s. 9d. to 8s. per ton f.o.b. Glasgow, ell 8s. 9d. to 10s., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 299,950 tons—a decrease of 7167 tons upon the preceding week, but an increase of 55,198 tons upon the corresponding week of last year. For the year to date, the total shipments have been 8,847,942 tons—an increase of 1,000,384 tons upon the same period of 1905.

SAWER AND PURVES,

THE POSITIVE PREPAYMENT METER.

MANCHESTER AND NOTTINGHAM.

Proposed Water Scheme for Londonderry.

The Londonderry Corporation have held a special meeting for the purpose of considering a report drawn up by Mr. G. F. Deacon, in conjunction with Mr. A. Stewart, on the question of extending the city supply, with the object of preventing a recurrence of the threatened water famine of October last year. Mr. Deacon recommended a scheme for bringing water from Cabry, in the Innishowen peninsula, at a cost of £83,000. He warned the Corporation that, unless the subject was tackled at once, there must be a serious situation within the next few years, owing to the increase in the population and the growing quantity of water required for the laundry industry in connection with the staple trade of shirt and collar manufacture. The Labour members proposed that the scheme be proceeded with; but this motion was met by the argument that there was no likelihood of Londonderry growing in the future at the same rate as it had done in the past, and that, with careful attention to waste, the present supply would suffice for the existing population. It was suggested that £1000 should be spent in introducing waste-detection meters. Eventually the report was referred to the Water Committee.

Water Supply in South Africa.

The first official report of the Rand Water Board, for the year ended March 31 last, shows that the market value at that date of stocks purchased by the Board had depreciated to the extent of some £10,000. This loss, it is pointed out, was due to shrinkage in the market value of Johannesburg Municipal stock, which was bought under par, and will be held until redeemed at par; so that there will be no actual loss on these investments. Stores on hand, after writing off depreciation, figure at £51,688. The balance of revenue over expenditure for the year amounts to £11,990, against which £9770 is charged and credited to the renewal fund. "It must be gratifying to all those who had the foresight to realize what a distinct benefit the formation of a Board to supply water without profit would be to the community," the Chairman (Mr. W. St. John Carr) points out, "to mark the progress that it is possible already to chronicle. The value of the property taken over from the Vierfontein Syndicate, about which doubts have from time to time been expressed, can be considered demonstrated by the work already done on the Zwaartkopjes Farm, from which it is estimated that all the water required by the Board to complete the 10 million gallon scheme will be obtained. Contrary to the fears expressed, the work of the Board may be said to have proved already, and is calculated to prove in a much greater degree in the near future, a very great benefit to the communities that lie within the area of the limits of supply." The estimated expenditure in connection with the scheme for the supply and distribution of the 10 million gallons of water daily is £793,000—a sum which, after allowing for interest on cost during construction, leaves a balance of about £400,000 at the disposal of the Board.

Fatal Street Explosion at Hastings.

Last Wednesday, an inquest was held at Hastings relative to the death of the infant daughter of a Mr. French, a solicitor's clerk on a visit to the town. Mr. French explained that the explosion occurred when he and his wife were crossing the road, and that the cover of an electric light chamber fell on the little one in the mail-cart, striking it on the head. The injuries were described by Mr. George Locke, surgeon, who stated that death must have been instantaneous. Sidney Swain, aged 14, of Hastings, said that on the day in question (Sunday evening), he saw three boys in company throwing wax vestas on the pavement. The matches caught alight on the ground, and made a report. They walked on; but one of the boys who followed up threw a match on the pavement, and it fired and skidded along the ground, and fell down the ventilator in the pavement. It was alight when it went down. An explosion followed immediately, and the cover of the inspection chamber was lifted. There were flames; and he heard a rumbling noise under the pavement. Then he heard an explosion, and saw a cloud of dust rise in the air. Charles Bard, mechanical foreman at the electric light works, said he was passing one of the boxes in Queen's Road, when he saw a flash and the corner of the box lift about 9 inches. He went to inspect it; and then heard another explosion near Water-Works Road. He gave information at the gas-works, and then went on to the electric light station. Just before the explosion, he saw three boys close to the box; but he did not see them cast any matches down. Mr. C. F. Botley, Assistant-Engineer to the Hastings Gas Company, explained that a slight fracture in a 4-inch main was responsible for the gas present; but he added that a flame must have been applied in some way to cause the gas to ignite. He considered that the fracture was due to some compression or subsidence of the ground. Mr. R. F. Ferguson, the Borough Electrician, said the weight of the cover that was blown up was 3¼ cwt. The electric cables were in no way injured. The spot was near the points of the tramway system; and the vibration may have had something to do with the subsidence and the consequent fracture of the pipe. Summing up, the Coroner said it was a stupid, silly thing for boys to throw lighted matches about. He was of opinion that the sooner a new system of ventilation was adopted, the better it would be for the safety of the public. A verdict of "Accidental death" was returned; the Jury deciding that there was no fault to be found with the Gas Company or with the Electric Lighting Authority.

Gas-Works Extensions at Abertillery.—Mr. M. K. North, M.Inst.C.E., one of the Local Government Board Inspectors, conducted an inquiry at Abertillery on Thursday relating to the application of the District Council for power to negotiate a loan of £1680 for the extension of the gas-works. The Clerk gave the net profits on the gas undertaking for the years 1903-6 as £1082, £2280, £1052, and £981. During last year several improvements had been carried out, and the cost defrayed out of the revenue. Mr. Lewis, the Assistant-Surveyor, said the present capacity of the works was 200,000 cubic feet per 24 hours, and the proposed loan would enable the Council to increase the capacity by 50,000 cubic feet per day. At the close of the inquiry the Inspector visited the works.

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Water Supply to Tenement Houses.

"So far as this borough is concerned," says the Medical Officer of Health for Shoreditch in his annual report, which has just been circulated, "the Health Committee, after inquiry, were satisfied as to what was being done to secure a proper and sufficient water supply for tenement houses; and it may be added that the matter of the water supply to all premises is one which has received a great deal of attention on the part of the Sanitary Authority in the borough. Shoreditch possesses many tenement houses in which every floor has a water supply of its own; the houses having been specially built or adapted for the purpose of being let in tenements. There are, however, numbers of small houses, of from four to six rooms each, which were built to accommodate single families, but which have come to be occupied by members of more than one family. To lay water on to the floors above the ground floor in many of these houses would involve considerable structural alterations. Sinks and waste pipes would have to be provided, otherwise the necessity would be continually arising of having to deal with houses flooded, owing to taps being left running. Moreover, in many of the houses the only possible situations to be found for the sinks within the dwellings, without radical structural alteration, would be within the dwelling-rooms themselves; and sinks in dwelling-rooms are not altogether free from objection on sanitary grounds, especially where there are children. The practice in the borough is to require additional water-taps where the circumstances appear to render the provision of them necessary in connection with tenement houses; but there is no hard-and-fast rule on the subject."

The Progress of Non-Electrical Lighting.

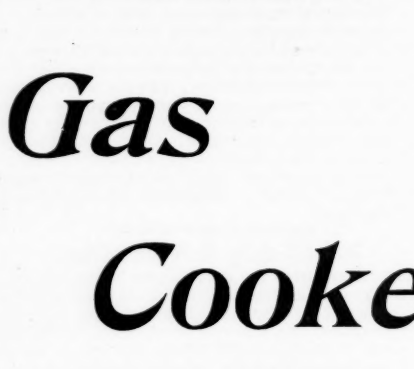
In a leading article on the above subject in the current issue of the "Ironmonger," the following remarks occur: "As we are concerned in these pages with the utilization rather than with the manufacture of artificial illuminants, we are impelled, in attempting a review of the progress that has been made during the past twelve months or so, to take a somewhat one-sided glance over the field of the lighting industry. On many occasions this would leave us with comparatively little to report; but in the present instance, although no epoch-making discovery has been announced, so many individually trifling advances have been effected, that the makers of gaseous illuminants and the dealers in accessories therefor ought to feel fairly satisfied with the general position of affairs. . . . In technical directions, the inverted gas-burner appears to be carrying everything before it. Only a few days ago it was announced that the Corporation of Edinburgh had decided to light the streets of their city with inverted burners. This burner is forcing its way into railway carriages, especially abroad. It is a little difficult to realize that a mantle will withstand the vibrations of trains; but this being proved to be the case, the inverted burner seems manifestly the best. Nevertheless, French results are in favour of the upright burner; and we are met with the curious situation that one large Continental company are busy fitting 'uprights' and another equally busy in fitting 'inverteds' to all the passenger rolling-stock. The beneficial effect of gas lighting upon the natural ventilation of rooms by diffusion, which, like the beneficial sterilizing action of naked flames, was formerly ridiculed, has been increasingly proved by experiments during the past year; and few people will now deny that the atmosphere of a gas-lighted and occupied room may be fresher at the end of an evening than the atmosphere of a similar apartment lighted with electricity."

An Electric Lighting Failure at Eastbourne.—During the evening of last Saturday week, the Eastbourne parades were practically in darkness owing to the failure of the electric light, and a number of streets in the town also suffered in a like manner. On the same evening in the week preceding, there was a similar occurrence; and it was then stated that a fuse in the mains was the cause.

Assessment of Birmingham Water-Works.—At the meeting of the Rhayader Board of Guardians on Thursday, a letter was received from the Radnorshire County Council desiring the Board's Assessment Committee to meet their Assessment Committee at a joint Conference in Llandrindod Wells, with the object of further discussing the question of the assessment of the Birmingham Water-Works. The Vice-Chairman said they had done very well with the Corporation—quite as well as they expected. For the time being, and for a year at least, he thought the arrangements should stand. The Clerk was directed to reply stating that the Board could not see their way to re-open the question till the expiration of the period for which arrangements had already been made.

Water Supply in North Warwickshire Villages.—The North Warwickshire Water Company possess, under their two Acts of Parliament, power to supply many villages lying some as near to Birmingham as Knowle, Dorridge, and Hampton-in-Arden, and the others close to Coventry. The Company have a pumping-station at Keresley and a reservoir at Corley. Some of the parishes named, including Foleshill, are already supplied from the sources at disposal; and now the Company have begun the laying of mains over the area, some 20 miles in length, from Keresley to Knowle. The route taken is through Brownshill Green, Hawksend, down to Allesley, and on to Meriden, Hampton, Knowle, and Dorridge; and it is proposed to erect a reservoir on Meriden Hill. There is already an ample supply of water for more than present needs; but with a view to meeting the necessities of the immediate future, fresh borings are being made, to be followed by pumping-stations. In a statement which has been issued to the shareholders, the Directors say the district is one which should prove a very profitable source of income to the Company; Knowle and Dorridge having already 570 houses erected, and other districts are also being rapidly developed. An endeavour was made to get a supply of Welsh water from the Birmingham Corporation; but the negotiations fell through. The supply will therefore be from the Company's existing wells. The scheme sketched above, so far as the laying of mains, the erection of machinery, &c., are concerned, is expected to be completed in nine months; and the estimated expenditure is about £17,000.

The "MAIN" Gas Cooker



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Gas, Electricity, and Water Supply at Zurich.

In the "JOURNAL" last week (p. 593), we gave some particulars in regard to the gas supply of Zurich in the past year, extracted from the annual report of Herr Weiss, the Municipal Gas Engineer. The financial results of the working were not dealt with for the reason that the accounts are presented in combination with those relating to the electricity and water undertakings. On the three sources of revenue, the profits last year amounted to £58,640, after provision had been made, at the rate of 4½ per cent., for the redemption of capital, as well as for depreciation of plant, and the usual contribution to the pension funds had been set aside. As the exact amount derived from each service in order to make up the total net profits is not stated, it is impossible to say whether or not the Electricity Department yielded anything towards them. It appears that the gas, water, and electricity supplied for public purposes are not charged to the respective undertakings; the service having been entirely gratuitous as from the beginning of 1905. It is estimated to be of the value of £16,000 per annum. The net profits of the three works represent 10 per cent. of the gross receipts, and the percentage rises to 20 if the sums devoted to the redemption of capital, depreciation, and the pension funds are included. The prices for the three services are so arranged as to devolve properly upon those who are best able to pay for them. The rate for heating and power gas, it appears, which is also largely used by poor people for lighting purposes, is 17½ c. per cubic metre, or 4s. per 1000 cubic feet; while for illuminating gas 25 c. (5s. 8d.) is charged. A few years ago it was desired to reduce the latter price to 22½ c. (5s.); but the proposal was not entertained, owing to the financial condition of the city. More recently, however, as the finances have undergone a considerable improvement, it was suggested to the Town Council that the charges for both gas and electric lighting, as well as for water, might be lowered. The price charged for water is on the basis of 3 frs. per room of a house; whereas the rate was only 2½ frs. in the old town of Zurich before it was amalgamated with the new one. The difference in the case of a house containing 30 rooms works out at 15 frs. per annum. The Town Council have now resolved to reduce the price of lighting gas to 22½ c. per cubic metre; but the question of lowering the water-rate has been rejected. There has not been any opposition to the cheapening of the supply of electric light, having regard to the necessity for ensuring in due time a sufficient sale for the energy to be obtained from the large hydro-electric generating station now being built at the Albula. Hitherto the price for energy furnished from the existing steam-power electricity works has been 80c. per kilowatt-hour. This rate has just been reduced to 60c. for summer, and 70c. for the winter consumption; while large consumers are to be granted rebates according to a sliding-scale. It is considered that the price might have been made still lower but for the desire not to bring the electric light into too strong competition with gas.

Illuminating Power at Salford.—It is stated that the Salford Corporation contemplate in the next session of Parliament seeking authority to lower the illuminating power of their gas, so as to enable them to make a reduction in price all round. The present standard is 18 candles.

Conscience Money.—The "Daily Chronicle" states that the Town Clerk of Burton-upon-Trent recently received from the Isle of Man 8s. and the following letter: "Herewith value of street-lamp broken by me in your borough some thirteen years ago.—Signed, with apologies, yours sincerely, Dei Gratia."

Accidental Gas Suffocation Case.—An insurance agent, named William Eaton, was some days ago discovered dead in bed at Swansea, with the gas-jet in the room turned half on. It is surmised that he accidentally knocked open the gas-tap after he had closed it, and that, as there was no outlet for the gas, he was suffocated.

Price of Gas at Rossendale.—Representatives of the Bacup and Rawtenstall Corporations and the Bacup and Rawtenstall Trades Councils recently waited upon the Rossendale Union Gas Company, with the view to obtaining a reduction of the price of gas. After hearing their application, the Directors of the Company promised to consider the matter, and report to the two Corporations. The price in Rossendale at the present time is 3s. 4d. per 1000 cubic feet.

Proposed Sale of the Wigton Gas-Works.—Meetings are to be held this week to consider the conditional agreement which has been entered into between the Directors of the Wigton Gaslight and Coke Company, Limited, and the Wigton Urban District Council, for the purchase by the latter of the works and undertaking of the Company for the sum of £8300, which is equal to about £16 per £10 share. The works were established in 1831; and £5160 capital has been raised.

Heywood and Middleton Water Board.—The Heywood and Middleton Water Board are arranging to promote a Bill in the next session of Parliament giving them power to borrow £125,000 for the purposes of their undertaking, and extending the time for the completion of the works authorized by the Act of 1901. Operations have for several years been in progress in connection with the Ashworth Moor reservoir; and a sum of between £160,000 and £170,000 has already been expended on the scheme.

Reductions in Price.—The Farnworth and Kearsley Gas Company have reduced their price 2d. per 1000 cubic feet to consumers up to 300,000 cubic feet, and 4d. to those using more than this quantity for ordinary or for manufacturing and motive power purposes. The Waterford Gas Company have decided to reduce the price of gas to 3s. 6d. per 1000 cubic feet all round, to take effect from the commencement of the current quarter. The charge for gas used for motive power will be 3s. 4d. per 1000 cubic feet.

Cheaper Gas for Warrington.—The Warrington Gas Committee have decided to reduce the price of gas within the borough by 2d. per 1000 cubic feet. At present the price in the borough is 3s. per 1000 cubic feet, with a discount of 6d. on accounts paid within one month. The charge will therefore, after the reduction takes effect, be 2s. 4d. per 1000 cubic feet net. It was stated in the "JOURNAL" for the 21st ult. that the net profit on the past year's working of the undertaking was more than £14,000, which was a record.

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Fears for the Texan Oilfields.— A special despatch from Galveston, Texas, in the "New York Times," states that the recent appalling earthquake in Chili has caused remarkable changes in the Texas oilfields. The wells are showing a startlingly rapid decline, and a new light oil is replacing the former crude oil. Scientists and geologists declare that new channels for subterranean reservoirs have been made by the shiftings of the earth, which will probably cause a speedy exhaustion of the oilfields within a hundred miles of the coast.

Pontypridd Water Company and Lead Poisoning.—It was stated in the "JOURNAL" a few weeks ago that some uneasiness was being caused in the district supplied by the Pontypridd Water Company with reference to suspected cases of lead poisoning. It appears that the Urban District Council issued a public notice warning consumers that the water supplied contained lead; and at the last meeting, a communication was read from the Secretary of the Company requesting the withdrawal of this notice. A letter was also read from the Pontypridd Trades and Labour Council complaining of the quality and the quantity of the supply, and asking the Council to convene a public meeting on the subject. Several speakers alleged that the water was unsatisfactory. Mr. T. J. Thomas said he knew of four cases in his ward where men were suffering from lead poisoning. The Clerk was instructed to write to the Company asking for information as to the future supply.

Suicides by Gas.—At Acton, on Monday of last week, an inquest was held on the body of Mr. John E. Bloom, a High Holborn tailor. The evidence showed that deceased retired on the previous Friday night in the ordinary way; but when his mother-in-law went to call him on the Saturday morning, she found him dead. He had a pillow over his face, and an india-rubber tube, with its end near his mouth, was attached to the gas-jet. He had suffered considerably from neuralgia, and had been worried over matters connected with his business premises. The Jury returned a verdict of "Suicide while temporarily insane." An inquiry has also been held at Fulham into the death of a young married woman named Mary Munton, who was found by her husband lying on a cushion, with her head inside the oven of the gas-stove; the gas being turned full on. Deceased was in bad health at the time; and the finding of the Coroner's Jury was "Suicide whilst of unsound mind."

Incandescent Lighting for Castle Donington.—At the last meeting of the Castle Donington Urban District Council, the Chairman (Mr. William Harvey) said that the Lighting Committee had met the Directors of the Gas Company, and had gone fully into the matter of public lighting. He was pleased to report that the Company appeared desirous of meeting the Council on satisfactory terms. If it were shown under the proposed system that the public lamps consumed a less quantity of gas, the Company would be prepared to make an equivalent reduction in their charges. That there would be a considerable reduction by the adoption of the incandescent system throughout the town, was indisputable; but the exact proportion could only be determined by tests. For their own guidance, the Company would test the new system; and he would advise that the Council also take the same precaution. Mr. Lambert said he could assure the Council that the Gas Company desired to be just and fair, and any proposal would be favourably considered. After some discussion, it was unanimously resolved that the whole of one of the main streets be lighted immediately upon the incandescent principle; and, in the event of the test proving satisfactory, the Lighting Committee were instructed to instal the system throughout the town.

The Directors of Stewarts and Lloyds, Limited, have decided to recommend the payment of an interim dividend at the rate of 9 per cent. per annum.

The Saxmundham Gas Company, Limited, has been registered with a capital of £5000, in £1 shares (3500 preference), to acquire the business carried on as the Saxmundham Gas-Works, and to adopt an agreement with Messrs. W. A. Schultz and C. Comins. There will be no initial public issue.

The Chemical Engineering Company and Wilton's Patent Furnace Company have recently secured contracts for complete sulphate of ammonia plants from the Cowdenbeath, Copenhagen, and Bishop Auckland Gas-Works; also three large plants for collieries, and one of their patent liquor stills to be put up at the Huyton and Roby Gas-Works.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

STATION SUPERINTENDENT. Nottingham Gas Department. Applications by Sept. 27.
GENERAL FOREMAN. Tottenham Gas Company. Applications by Sept. 17.
DRAUGHTSMAN. No. 4645.
CLERK. Romford Gas Company.
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MAINTENANCE DEPARTMENT. No. 4643.

Situations Wanted.

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WINCHESTER WATER AND GAS COMPANY. Oct. 13.

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BELFAST GAS DEPARTMENT. Tenders by Sept. 13.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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